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Manufacturers' Association Urge Industrial Research

EDITORIAL mention was made in our last issue of the recently formed Canadian Industrial Reconstruction Committee and their attitude towards the establishment of a National Research Institute and the extension of the research work in our universities. Sympathetic action has also since been reported by the Canadian Manufacturers' Association, who at their recent annual convention in Montreal passed a resolution which is being sent to all members of the federal government. The resolution calls for manufacturers' representation on the Honorary Advisory Committee of Scientific & Industrial Research on a basis equal, numerically, with the academic representation, and urges the establishment of a research laboratory for furnishing information relative to new processes, properties, inventions, improvements, etc. The full text of the resolution runs as follows:—

Resolution on Scientific and Industrial Research

Whereas in the principal industrial countries the application in industry of results obtained by scientific investigation is recognized as a most important factor in maintaining a high industrial rank and increasing national prosperity;

And whereas realizing that it is not purely an industrial problem, but for the ultimate public good, governments of the principal industrial countries have set aside large appropriations for the assistance and encouragement of scientific research as applied to industry;

And whereas the immediate government provision in Canada for the application of scientific discoveries in industry is at a minimum;

And whereas industries have guaranteed financial co-operation on a considerable scale for a period of years, provided government action is forthcoming;

Be it therefore resolved that the Canadian Manufacturers' Association , in annual meeting assembled, strongly urge the Dominion Government in prompt action:

(1) To provide for the appointment of manufacturers in representative industries on the Honorary Advisory Committee of Scientific and Industrial Research on a basis equal numerically to the academic representation now thereon.

(2) Under the supervision of the Honorary Advisory Committee, in co-operation with the industries on terms to be agreed upon, to establish, equip and maintain a laboratory for conducting scientific industrial research and furnishing information relative to new processes, properties, inventions, improvements and materials discovered therein as may seem capable of use by interested manufacturers;

(3) To provide funds to carry out this project or another similar plan suitable to Canadian industrial conditions which plan shall have the same end in view.

What Good Roads Do For the Dairy Business

GOOD roads mean better and cheaper milk—better because less delay is entailed in delivering from the farmer to the consumer—cheaper because of improved methods of delivery and time saved and also because these, in turn, will induce the farmer to produce more. Mr. G. R. Rice, secretary-treasurer and general manager of the Milwaukee Milk Producers' Association, believes good roads are an investment for any community. We quote from a recent letter:

"There were times when fifteen cans of milk would make a good load for a team of horses, and it was impossible to run trucks of any nature. At the present time most of the milk is being brought in on trucks of various kinds and the load runs from 50 to 100 cans. This comes in daily without trouble after once getting on the good road.

"The output of milk possibly has not been affected by the good roads, but the cost of getting it in is now much cheaper and the time of delivery is shortened, consequently the milk gets in in much better condition and the proportion of loss from soured and such like is lessened."

Mr. Henry Behrns, president and general manger, Cedarbury Milk Co., a distributing organization, says:

"Formerly the milk from these roads was drawn in by horse and wagon. At this time all the milk from the different roads is hauled in by auto truck, which it would be impossible to do if they still were the old dirt roads.

"I cannot say exactly what the price per can is less than it was in former years, but if we consider the

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enormous increase of the cost of hauling at this time, I would say, even paying the same price that we did in those years, we are saving, not overestimating, twenty-five per cent. on the cost of hauling. Milk that was hauled in by the teams, at its best got in from two to three hours later than it does hauling it with the auto truck on say about a twenty-mile haul. This in itself is an enormous saving, as the product in the hot summer months or in the cold winter days is considerably improved by quick delivery.

"Furthermore, where one man with two horses, which team had to be changed every other day, could haul approximately 40 cans a day, to-day he can haul with a two-ton truck approximately 100 8-gallon cans, as it enables him to make two trips, while only one trip could be made with the horses.

"I would also say that the better road has encouraged the farmer to produce more milk as it is easier for him to haul his feed to and from the place, as generally the man who produces milk has to buy a lot of fed from the outside.

Provincial Builders' and Supply Association Convention

ON Thursday, June 20, seventy-five delegates gathered at Galt, Ont., for the sixth annual convention of the Provincial Builders' and Supply Association. The opening session was held in the S. O. E. Hall, and Mayor W. S. Dakin extended a hearty welcome to the delegates and tendered them the freedom of the city. The largest representation was from the cities of Toronto, London, Hamilton, Stratford and Chatham.

The election of officers, which took place early on the programme, resulted as follows: President, A. Tomlinson, Chatham; first vice-president, Lieut.-Col. G. Youngs, Stratford; second vice-president, Robert Elgie, Toronto; secretary-treasurer, T. R. Wright, London; executive, G. A. Robb, Galt; J. S. Adamson, Ottawa; A. Hannaford, Hamilton; J. Norton, Sarnia; E. Blondie, Chatham; R. Masson, Stratford; F. Nicholson, St. Catharines; S. Willis, London; G. Stocker and G. J. Oakley, Toronto; auditors, D. Davidge, Toronto; and E. Gerry, London.

An interesting feature of the programme was an address by Mr. G. Gander, of Toronto, regarding the operation of the Workmen's Compensation Act. Mr. Gander, who was chairman of a committee on this question, stated that the workingman had benefited to the extent of $83,514, from the first aid amendment to the Act, during the last six months. Of that amount $8,167 had been paid by the building trades, but with due care the amendment should not cause an increase in present rates. The opinion was expressed that some other plan of assessment, such as current cost, should be devised and adopted, and the rates might thus be lessened as the committee hardly thought it necessary that such large funds should be accumulated as at present. The amount now standing to the credit of the Workmen's Compensation Board was something like $4,000,000. However, Mr. Gander commended the Board for the fair and economical manner in which it was administering the Act.

Mr. Robt. Elgie, of Toronto, spoke regarding the necessity for supporting and protecting home trade, making special reference to the practice of bringing in foreign contractors to do work in this country to the detriment of Canadian firms. Mr. Elgie read a memorial on this subject, which was endorsed by the association, and is to be presented to the Dominion Government with a view to having the operations of foreign contractors in Canada regulated.

The matter of changes to the lien law came up for discussion, and Mr. W. E. Dillon, of Toronto, pointed out that the Act did not give the sub-contractor and supply firms the same privilege of lien as the general contractor, and that it allowed the owner to mortgage labor and material that he had not paid for. In addition it did not provide for liens on public works. The percentage held by the owner, Mr. Dillon said, was not enough in all cases to pay the claims of the sub-contractors and supply firms, and he also criticized the procedure which made it necessary for the workman to go through the same formality as the contractor, thereby causing him delay in getting his money, which he could not afford. Another point mentioned was the 25 per cent. fee allowed to lawyers, this being considered too much when the amount exceeded $100. Following the discussion, a committee consisting of Messrs. Tomlinson, of Chatham; Wright, of London; Webster, of Galt; Pounder, of Stratford; Murray, of Hamilton; Nicholson, of St. Catharines, and Gutridge, of Sarnia, was appointed to deal with the proposed alterations to the law.

The final session on the afternoon of Thursday, June 21, was chiefly occupied with a discussion of after-the-war conditions, and it was pointed out that a large immigration to Canada was to be expected when the war ended, with resulting activity in the building trades.

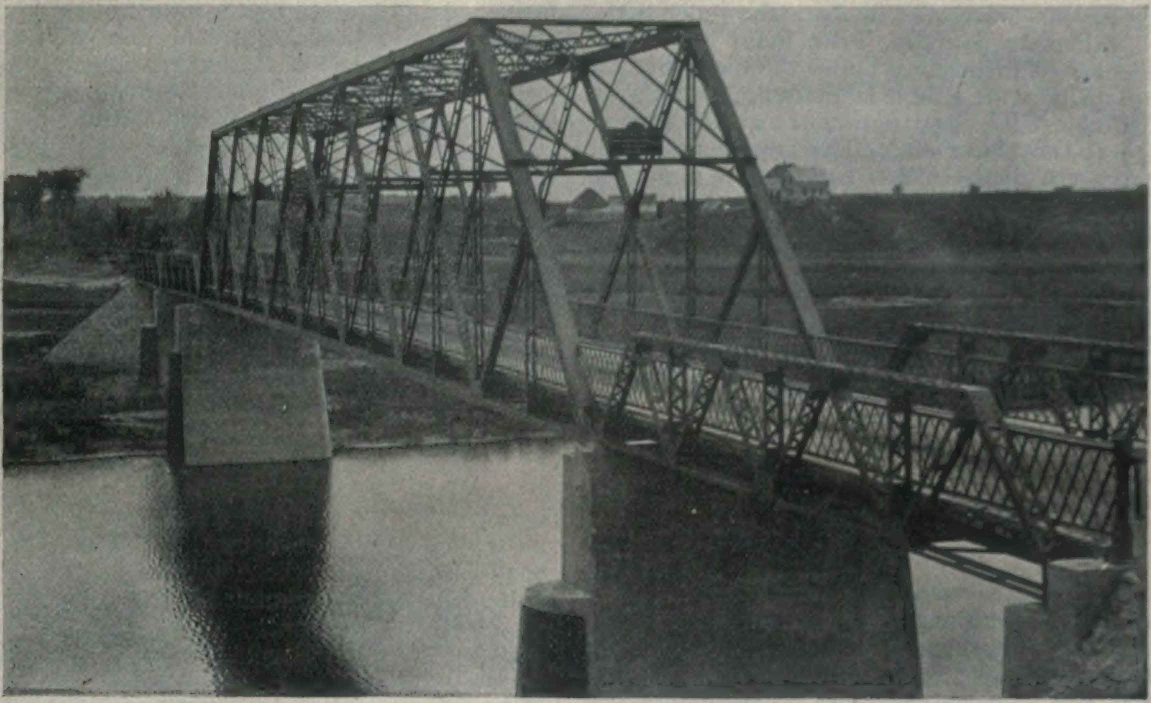
Introducing a little entertainment for the benefit of the visitors, the local Builders' Exchange got up a theatre party for the first night of the convention. Also on Thursday morning, the delegates were taken over the city and visited some of the industrial plants, although rain interfered somewhat with the original programme.

The Association decided to hold their next year's convention at Chatham, and the time was set for the second week in February, that being a more convenient season of the year than the month of June.

Promotion by Merit

OUR Union Government has given evidence of their sincerity regarding the abolition of the patronage system in the promotion of Mr. W. E. Lemon to the City of Toronto postmastership. It is true Mr. Lemon is eminently fitted for the post, but this, in the past, has not been considered sufficient qualification when in competition with importune politicians who have had to be provided for. It is to be hoped the old system is gone forever. Without doubt the appointment of Mr. Lemon will have a good effect throughout the Canadian Civil Service, the members of which will see in it a recognition of the principle that merit and devotion to duty are the determining factors in selecting men for positions of greater trust.

It is announced that heavy munition orders have been placed in Canada during the past few days, and that others are under consideration at the moment. This will doubtless entail extensions to factory buildings and equipments in a number of cases and in certain instances require entirely new buildings. These orders should thus introduce a very considerable activity into the building trades within the next few weeks.



Bridge de l'Ile a la Fourche a St. Jean Batisse de Nicolet—View from south-east.

Four-span Steel Bridge over the Nicolet River

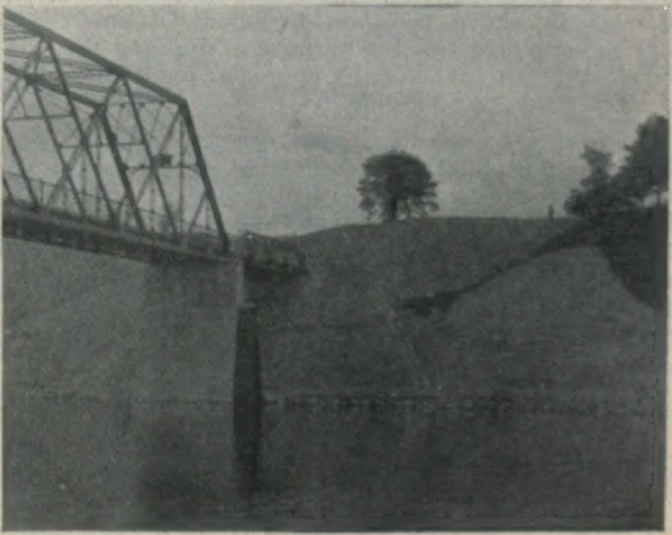
The "L'Ile a la Fourche" bridge over Nicolet River, at St. Jean Baptiste de Nicolet, Province of Quebec, has recently been completed. The site of the bridge is about 500 feet above the point of junction of the east and west branch of the Nicolet River, approximately 1½ miles from the town of Nicolet, situated on the south shore of the St. Lawrence a short distance above and opposite Three Rivers which is half way between Montreal and Quebec. Nicolet is a small town of about 3,000 population and is advantageously known in the province. The Nicolet River takes its source in Nicolet Lake, in the township of Ham, Wolfe County; runs through the townships of Ham, Chester, Arthabaska, Warwick, Bulstrode, Horton and Aston, and then discharges into Lake St. Peter, in the St. Lawrence, three miles from the town of Nicolet. Its length is 60 miles, and its watershed is 1,336 square miles; its course is rapid and navigable to a certain distance from the town of Nicolet. The river is formed of two branches, known as east and west branch, and covers a large area of fertile lands.

Champlain, founder of Quebec, in 1609, gave it the name of River du Pont, in honor of his friend Pontgrave. The name of Nicolet was later substituted in memory of Jean Nicolet, discoverer and interpreter. The name Nicolet was afterwards applied to the village, and later still to the town and diocese.

The river is remarkable; in summer it has been noted that practically it appears dry, and if it rains for a few hours the level of water is raised sensibly; during flood time, particularly in spring, the level of water rises as high as 25 feet. The river is subject to high rise of water, and a few years ago many wooden bridges were carried away by ice, water and debris of all kinds. The west bank is flooded every year.

Historic

The question of building a bridge at this place has been discussed for many years, and, in 1908, the municipality started the construction of a suspension bridge with floor suspended on cables and made of old rails. The center span was to be 300 feet, and the shore spans 114 ft. and 71 ft. respectively. Once the substructure was completed, this type of bridge was



Showing the protection works on the east slope.

abandoned, following a report of the engineer of this Department and for other reasons. The project of the bridge at this place was likely to be indefinitely postponed, when, in January, 1910, many interested persons associated themselves under the name of "La Compagnie du pont de l'Ile a la Fourche," having as its principal object the construction of a steel highway free bridge at the above site. The engineers of the Department were then called to prepare plans for same. Those interested, desiring the most economical construction, insisted that the new bridge be built on the same site, using as much as possible of the substructure of the old suspension bridge. The units of the old project which have been used are the west anchorage and pier on which was to rest the tower supporting the suspension cables. The project as prepared by the Department included the raising of the west anchorage or abutment and its reinforcing at the front against the fill pressure at the back; the putting in place of a concrete protection at the base of the old pier to protect the latter against washouts; the construction of two new piers and one abutment on the east bank.

The superstructure comprises four spans, one of 50 ft., one of 235 ft. and two of 77 ft., the whole forming a total length of bridge of 453 feet between abutments. The plank floor of the bridge is 16 feet in width and is at 31 feet above water level. The photos annexed show the bridge as built and completed last year.

During the execution of the works, many difficulties arose necessitating accessory works. Following the completion of the substructure and at a time when the erection of the superstructure was nearly completed, there occurred a big slide of the east bank adjacent to the abutment. So as not to expose the bridge, it has been found that certain repressive and consolidation works of the bank on each side of the east abutment were necessary. The geological top layer of the east bank is clay and has a tendency to slide towards the river under the action of gravity or water in it or from atmospheric effects. It was thus found necessary to have the following works executed: A stone protection in front of the east abutment retained by a dry stone wall, the base of which is inclined towards the bank; previously to the construction of this wall, a pipe was laid to drain all water contained in the bank or which might accumulate otherwise. In fact, this drain actually fulfils its object and water flows in it; besides the above, trenches, ditches and kennel-stone drains were made for the purpose of draining the surface water, also that of the approach road which has a steep grade on that side.

The slopes were all cleaned, dressed and protected from running, filtering and thawing waters and of atmospheric effects by the construction of the above kennel-stone drains and ditches and by covering them with a mattress made of branches, rammed earth and stone consolidated at the base by two rows of piles placed 6 feet apart, driven in the ground and connected to one another by waling pieces spiked to them. This dyke work is placed along the shore and is filled with stones. The slopes of the east bank have been sodded.

The above work completed a year ago was not damaged last spring and is proving effective after the heavy rain storms we had recently, the drainage having been well taken care of.

All the substructure works and approaches of this bridge have been executed by the Nicolet Construction Company, of Nicolet. The superstructure was furnished and erected by the Phoenix Bridge and Iron Works, Limited, of Montreal. The whole has been executed in accordance with the plans and instructions of the Department of Public Works and Labour, Quebec, of which Mr. L. A. Vallee is the chief engineer.

A Riveting Record?

A short time ago a paragraph appeared in the daily press announcing that "Charles Schock, a Baltimore riveter, had shattered the world's record for driving rivets, having driven 2720 rivets in a nine-hour day." Inspired by this alleged record a squad of riveters in the employment of Fraser and Fraser, Limited, Bromley-by-Bow, London, E. 3, asked the firm to be allowed to make an effort to surpass it. The management consented, and on Tuesday, at 6.30 a.m., the effort was commenced in connection with margarine tanks on order for the Ministry of Food. The "Engineer" reports visiting the works in the course of the afternoon, and finding that even before the dinner interval the squad had surpassed the American record. The details of the complete performance are as follows:

Riveter: R. Farrant. Working day: 9 hours

Time	Rivets driven.	Rate per hour.
6.30 a.m.	nil.	—
7.30	536	536
8.30	1032	496
	Half-hour interval.	
9.30 a.m.	1304	544
10.30	1823	519
11.30	2257	434
1.0 p.m.	2920	442
	One hour interval.	
2.30 p.m.	3100	360
3.30	3550	450
4.30	4007	457
5.0	4276	538

Thus an average of 475 rivets were knocked down per hour, or one rivet every 7.58 sec. It is interesting to note that the maximum rate of working was reached in the half-hour after the breakfast interval, although the spurt made during the last half-hour very nearly reached the same level.

The American "record" has thus been beaten by an increase of 57 per cent. in the output. It is, however, not quite fair to detract from Mr. Schock's performance, because we do not know what size of rivets he knocked down, what arrangements were made to assist him in his work, or what tools he used. In the rival performance put up by Mr. Farrant, the rivets were ½in. diameter by 1⅛in. long. On the riveter's side the rivets were mostly snap headed, a few in each tank being countersunk flush. On the holder-up's side the rivets were all countersunk flush. The tool used was an Ingersoll-Rand "Little David" pneumatic riveter, weighing 28½ lb. The holder-up used a hand tool weighing 16 lb. Besides the riveter and the holder-up the squad comprised five other men or boys. Of these one was stationed beside the riveter to remove the temporary bolts in the tank as required, to knock the loose rivets as delivered from the fires into the holes, and otherwise to assist the riveter. Two fires, blown by means of compressed air, were kept going, and at each of these a boy was employed heating the rivets. Two other boys carried the rivets from the fires to the tank. The total squad thus comprised seven individuals.

Housing Crisis Demands Government Action

IN a recent issue we drew the attention of our readers to the serious situation in many of our large towns and cities regarding the lack of proper housing accommodation. In the interval the matter has been taken up by the Canadian Manufacturers' Association,, who have had an interview with Premier Hearst, with the result that a Housing Branch of the Ontario Resources Committee has been formed. The necessity for action is also very distinctly set out in the report which the executive committee of the C. M. A. presented at their annual convention. This report points out that huge sums have been spent in establishing war industries employing thousands of workers, but that no corresponding policy has been determined regarding the housing of the workers. In view of the fact that the workman's efficiency largely governs his output, and that he cannot be efficient unless his hours of recreation and recuperation are spent under favorable conditions, it would appear that the government has not gone quite far enough to secure the best results in quantity and quality of product. We quote from the report:

Industrial Housing.

The working-class housing conditions in the industrial sections of Canadian cities were far from satisfactory before the war, but in the last three years they have been growing steadily worse. When our soldiers return in large numbers this condition will be further complicated. Private enterprise, for obvious reasons, has ceased to operate in building houses to any large extent. Want of an adequate supply of new houses drives a growing population more and more into available dwellings which are unsuitable for habitation, causes overcrowding, and greatly increases the contribution which the worker has to pay for shelter.

If the population of the country were to continue to spread evenly, and if the migration from the country to the city were to cease, the failure of private enterprise might not be a serious matter, for some time at least. But as we create new industries, and cause the expansion of some old industries for war purposes in certain restricted areas, and attract large quantities of labor to these areas, we develop a serious condition of drift of population which creates serious housing problems. We may have as many houses as before, but not in the right places where the drift has gone.

Government factories have been erected in Canada, and no provision made to house the workers, and large war orders have resulted in private corporations greatly increasing the population of certain districts, but making no attempt to shelter that population in decent homes. Bad sanitary conditions and overcrowding have grown up as a result.

The British Government, through the Imperial Munitions Board, has erected and financed munition plants to an extent of over $14,000,000 in Canada, employing 6,200 workers. This is in addition to the munition work being done by the Canadian Government and by private corporations. The Prime Minister is reported as saying that the above Board has spent $64,500,000 in shipbuilding and that the Canadian Government has appropriated $25,000,000 for the same purpose. In some centres overcrowding and overrenting has been caused by other forms of war activity carried on by Government agencies.

No housing policy has been determined in connection with any of the above enterprises. While the Imperial Munitions Board is representative of the British Ministry of Munitions, it has apparently no power to do in Canada what the Ministry regard it as essential to do in Britain to secure efficiency in production. The housing and social welfare branches of the Ministry are huge organizations, and are looked upon as important parts of the machinery of war; but above all they are being used to lay the foundations for industrial reconstruction after the war. Are we in Canada going to suffer material loss as a result of neglect of this aspect of war industry, or are the British people wasting their money and time?

These are matters for the Government of Canada to consider. In Great Britain it has long been recognized that the government of a country has a distinct responsibility in regard to the housing conditions of the people, apart from those engaged in war industries. Before the war many millions of Government money were invested in housing schemes, promoted either by municipalities or by public utility societies. These schemes were carried out to meet needs no greater than those which have had to be met in Canada.

Whatever answer may be made to the above question regarding what should be the Government housing policy in Canada, it cannot be met by the answer that conditions are materially different from those in Great Britain. The war has produced a similarity of problems and conditions, although from experience in dealing with housing problems in the past, the matter is approached from a different point of view in Britain than on this continent. In the United States and Canada, the tendency has been to leave these matters to private enterprise—with fairly satisfactory results outside of the crowded parts of big cities.

But the war, and Britain's example, have brought about a complete change of policy on the part of the United States Government.

The work of Britain in this matter, considering its proximity to the battlefields of France and its reliance on naval protection for its food supplies and its very existence, has been truly remarkable. We have heard little of it in Canada, but it is widely known and appreciated in the United States.

Comparatively early in the war it was realized in Great Britain that the war had to be fought by the civil forces at home as well as by the men standing in the trenches, and that a necessary part of the equipment of the civil forces would be good housing accommodation. The necessities of war and of strengthening the national structure so as to enable it to withstand the consequences of war have created a new outlook on such social questions as housing and town planning.

In answer to a deputation representing the Toronto Branch and other interests which interviewed Premier Sir William Hearst at Toronto on 28th ult., he suggested forming a Housing Branch of the Ontario Resources Committee, so that in Ontario at least definite action seems assured.

Calculating and Preventing Silt Deposits in Reservoirs

ONE of the most troublesome factors in the design of waterworks systems where the water from watercourses is run into a reservoir, is that of the silt deposit. In designing water systems it is important that data be acquired to enable the designer to estimate how long it would take a reservoir to "silt up" and how best to prevent this objectionable feature. It is evident that the amount of matter in suspension and the material which is rolled along the bottom of a stream by the current can only be estimated after some study has been made of geological and hydraulic conditions prevailing in the district under consideration. The following article by Felix Drouhet, in Le Genie Civil, gives some of the methods used and results obtained in Switzerland.

Determination of Amount of Suspended Sediment

As it is desired to determine the amount of sand or rather of sediment in suspension in the water of a river, and having determined the hour and the day when the water level reaches its maximum, it is desirable at this moment to take two or more samples from the stream. These samples must be taken as near as possible to a gauging station which can be located in succeeding years; where there is a good section and where the bed of the river may be changeable. They must be taken instantly. The Water Service of Switzerland uses a metallic receptacle of 700 cubic millimeter (.042 cu. ins.) capacity, the bottom of which is conical and provided with a tap of smaller diameter like the neck of a bottle, arranged to facilitate the transfer of the water into the receptacle.

The determination of the amount of material in suspension, is by means of weighing and it is necessary to know the volume of the alluvium after it is deposited in the water, which volume varies with the degree of settling or separation. To calculate this it is necessary to know its density in the water, that is to say, the state of the sediment in the receptacle or the imaginary density, $d = P/r$; P being the weight of the dry alluvium, and r being the volume of the container; and it is this theoretical density that serves for the calculation of the amount of alluvium. The content of alluvium varying at different hours of the day, it is necessary to take samples at different times and determine the average.

For the River Rhone, for example, the quantities that are obtained for the total amounts carried during short periods vary from 30.744 kilograms (67.83 lbs.) to 185.291 kilograms (412.99 lbs.). It is well, therefore, when only taking one sample daily, to know the daily variation of the water course, to be able to make the necessary corrections. Moreover, it is necessary to know at what depth the samples must be taken, because in the case where the current begins to agitate the material on its bed, the initial action is not the carrying of the material on the bottom, but of raising it and maintaining it in suspension for certain distances and then depositing it again. This is the reason for the existence of a covering of sand more or less extensive on the beds of rivers. This amount may vary also from the middle to the sides, as shown by the samples taken from the Rhone at Sion. However, the results obtained for any certain water course cannot be applied indiscriminately to other rivers, for there is a difference due to the current, as shown from the samples taken on the Rhone and on the Garonne. Results also vary with the temperature of the water, the speed of the current, and the presence of fine silt.

Bearing of Hydrographic Data on Determination of Suspended Matter.—The hydrographic data has an important bearing on the determination of the carriage of alluvium in suspension per day, month, or year. It is necessary to know as closely as possible the quantity of flow, and any gauging mistake is multiplied by 31,536,000 seconds for a year. For example, in the extensive study made by Boeff, in 1890, on the flow of the River Arve, the results, based on an average annual flow of 54.36 cubic meter (1,919 cu. ft.) per second, must be modified, as the result of ten years' study by the Hydrographic Service of Switzerland, which shows an average annual flow of 77.20 cubic meters (2,726 cu. ft.) per second.

If we study the curve showing the quantity of alluvium in suspension in the Arve in 1890, after Baeff modified, and the one showing the rainfall in Geneva for the same year, the close relation between them will be noted. The maxima corresponding to the variation of water and of alluvium occur at the same time; moreover, the maximum amount of alluvium usually corresponds to the beginning of the water "wave," and the alluvium "wave" increases and diminishes quicker than the water "wave."

Method of Preventing Silting Up of Storage Reservoirs.—It is wise to take precautions against the filling in from alluvium at hydro-electric plants. The hydro-electric plant of Martingy-Bourg and of the Societe d'Electrochimie that are located on the River Drance, which carries a large amount of alluvium, have made interesting installations to clarify the water which have given excellent satisfaction. The settling plant is formed, first, of a double surface intake for the water; and, second, a separation or sand cleaning chamber capable of being cleaned from the bottom. The double surface intake is formed by an intake proper, 30 meters (98.42 ft.) long, the highest part of which is 1.5 meters (4.08 ft.) above the height fixed for the main dam, so that when the river carries alluvium, only the surface water for a depth of 0.5 meter (1.64 cu. ft.) can enter the channel. When there is no alluvium it is allowed to take all the water. From here the water goes into the intake canal, provided with a sluice gate for cleaning, where the water is clarified to some extent. The surface water passes into a second reservoir through perforated plates 6 millimeters (.23 in.) thick, with a total surface of 120 square meters (1291 sq. ft.), which will retain alluvium which has over 12 millimeters (.47 inches) diameter. From this the water goes through a subterranean conduit to the plant, on a grade of 2.5 per cent.; one part being deeper and larger at 2 kilometers (1.24 miles) from the intake, forming the chamber for the removal of the alluvium.

This chamber is 36 meters (118 ft.) long, 7 meters (23 ft.) wide, and about 4.3 meters (14 ft.) high; it is divided into three longitudinal compartments by two walls. The central one is provided with a sluice gate at the entrance and serves as the exhaust channel or sluice way for restoring the water and alluvium to the river. The two side compartments form the sand cleaner proper. Each of them is divided by baffles or partitions which reach neither the bottom nor the water surface, so that the water, forced to rise slowly between the baffles or partitions, deposits part of the alluvium, which is carried to the bottom and discharged through a sluice gate into the channel.

The results obtained when the Drance carried such a large quantity of alluvium in July and August, 1909, left only from 3 to 4.6 grams (.1 to .16 oz.) per litre (.26 gals.) in the water for the turbines, when the Drance carried from 10 to 33 grams of alluvium per litre; and only 0.13 grams to 1.1 grams in 1913, when it carried from 0.20 to 2.8 grams, thus proving the efficiency whether the amount carried is large or small.

The sand cleaner constructed at the plant of the Societe Energia Electricite de Catalina on the Flamissel in the Pyrenees, was erected in the intake channel. It was of the Koechlin type and is a settling basin with two chambers. The water passes through a horizontal grillage, thus stopping the suspended matter after passing under the arch. When the water rises it leaves the matter it held in suspension on the bottom of the chamber, which has a slope of 7 per cent. The water freed from the greater part of the sand passes into the clear water intake channel which has a sluice way connected with the exhaust channel. Each chamber can be used alternately.

Rolling Movement of Materials Along Bed of Stream. The velocity of current necessary to carry stones of various sizes over a smooth or a rough bottom, was determined experimentally by L. Sudry. The movement of materials rolling along the bed of a stream is a very complex problem in which the diameter of the pebbles of more or less rounded shape and the finer materials in the voids have a very important part.

M. Collet desired to find the relation existing between the rolling materials and those held in suspension, and took as a basis the results of the experiments made on the Rhone at Loueche Sonste, where the water was completely dammed at the intake of the Chippis plant, and where it was easy to determine the amount of suspended matter in the water and also the cross sections. His results were as follows: the Rhone rolls along its bed in 18 hours, 2,303 cubic meters (81,328 cu. ft.) of stones and sand; when the height of the stream was less than normal, and during the same time the matter carried in suspension was for the case studied 1 to 1.

A study made on the Verdon at Quinson by M. Wilhelm shows that the stream rolls 25 cubic meters (882 cu. ft.) of pebbles per year per square kilometer (.38 sq. miles), and transports 7.5 cubic meters (265 cu. ft.) of clay and silt per year per square kilometer.

The results obtained on the Avre by M. Lugeon show the annual amounts carried at Geneva to be 146,000 cubic meters of pebbles and 700,000 cubic meters of sand and silt, or a proportion of 1 to 4.8.

When certain data are wanted it is necessary to make experiments on the particular river, as no two show the same results.

A New Move Against the Submarine

The "Engineer" prints an interesting editorial in a recent issue, headed "A new move against the submarine." Since the outbreak of war the "Engineer" has apparently been in pretty close touch with technical development in the British Isles, as indicated by information printed from time to time, and their encouraging remarks regarding the naval situation are all the more interesting. We quote from the editorial in question:

Because most of the work is necessarily performed in silence, the public do not realize with what skill, energy and determination the Navy is waging war against the hostile submarines. Everyone has heard of the thousands of patrol vessels—destroyers, motor launches, trawlers, drifters, and the like—which in home and foreign waters are guarding the trade routes and hunting the elusive enemy. It is commonly known too, that aircraft of many types are doing good service in the same direction. But this, in the popular mind, is the sum total of the Navy's anti-submarine activity. The dashing raid on Zeebrugge and Ostend was therefore hailed with extraordinary enthusiasm, for it was interpreted as a sign that the Admiralty has adopted a more aggressive policy in relation to the underwater pest. But this idea is largely fallacious, and not altogether just to the naval authorities, who for many months past have been tackling the dominant problem with all the vigour of which they are capable. Plans of far-reaching importance have been framed, and the means of carrying them into effect have been steadily maturing for a very long period. But they were plans that called for large supplies of material, which could not be manufactured in the requisite quantity at short notice. There has been a great deal of talk about laying down sea barriers through which no submarine might pass, but people who make such suggestions are too apt to overlook the practical difficulties they would involve. In point of fact, both the merits and limitations of the sea barrage have been under the careful consideration of the naval authorities ever since the submarine menace became really serious. Quite early in the war tentative experiments were made but the results were not wholly encouraging. Since then, however, technical developments on the one hand, and improved manufacturing methods on the other, have eliminated most of the original objections to stationary anti-submarine defences. Last week the following announcement was made by the Admiralty: "In view of the unrestricted warfare carried on by Germany at sea by means of mines and submarines, not only against the Allied Powers, but also against neutral shipping, and the fact that merchant ships are constantly sunk without regard to the ultimate safety of their crews, the Government gave notice that, on and after May 15th, 1918, the following prohibited area will be established in the North Sea dangerous to all shipping and should be avoided." The data of latitude and longtitude appended to this statement show the new "barred zone" to lie between the North of Scotland and the coast of Norway. We need not assume that every square mile of the area is thickly sown with mines and other hidden dangers, but the fact remains that navigation within it will be attended with grave risk.

Mines and the Barrier Defence.

That is should have become feasible to establish this new minefield is a tribute both to the thoroughgoing policy of the Admiralty, and to the resourcefulness of British industry, without whose zealous co-operation the necessary material could not have been accumulated. The outbreak of war found the Navy strong and well-equipped in most respects, but hardly in a position to undertake mining operations on a large scale. Our reserve of mines was small, and those we had were not of the most efficient type. So much has been frankly admitted in Parliament by Lord Lytton and other Admiralty spokesmen. The reason for this deficiency in numbers and quality is not far to seek. No one could have foreseen the singular turn which naval operations took with the introduction of the submarine "querre de course" by the German Government. In this country the sea mine had always been regarded primarily as the weapon of the weaker Power, and as such it seemed of problematical value to a Navy which made the seeking out and destruction of the enemy's fleet its main objective. Contrary to popular supposition, at no time during the war has the German High Sea Fleet been blockaded in the strict sense of the term. The British Navy has been anxious, not to keep it in, but to bring it out. On our side therefore the utility of mines was obviously restricted, and it was not until the enemy, renouncing all thoughts of grand strategy, began to concentrate his effort on the submarine war against shipping, that we found it expedient to "mine him in". Our new mines, it is no secret—least of all to the enemy—leave nothing to be desired in the way of deadliness. That they are now available in very large numbers is attested by the establishment of the new danger zone. Henceforth German submarines will find it no easy matter to steal out of the North Sea on their predatory enterprises. At the southern exit they will have to negotiate the permanent drifter barrage which, as the First Lord recently stated, extends right across the Straits of Dover. In the north they will be confronted by this new extensive minefield.

We are not so sanguine as to expect that from this time onward hostile submarines will be unable to break out of the North Sea. It would, we believe, be physically impossible to erect an impermeable underwater barricade stretching between Scotland and Norway, a distance of nearly 300 miles. At certain seasons of the year those waters are swept by violent storms, which would speedily demolish the most elaborate submerged obstructions that could be laid down. But we do anticipate with some confidence that the German submarine war will be impeded and rendered far less dangerous as a result of this new "barred zone." The outburst of fury with which the Admiralty's announcement has been greeted by the German Press tells its own tale. Vituperation is the enemy's way of acknowledging a home thrust. Lord Jellicoe not long since cautioned the country against premature optimism with regard to the defeat of submarine lawlessness. Serious losses were almost inevitable, he warned us, adding, however, that by the coming August optimistic speeches might be more justifiable. The late First Sea Lord was, of course, fully cognisant of the preparations which were then in progress with a view to increasing the efficacy of our anti-submarine tactics. Indeed, we shrewdly suspect that he himself deserves much of the credit for imitating the new measures and accelerating their execution. With the Navy giving so many proofs of its unremitting vigilance and high technical capacity, and with the shipbuilding situation, both here and in the United States, improving month by month, we may contemplate the future without dread for the ultimate collapse of the submarine "querre de course" seems assured.

Construction of Highways for Military Traffic

MR. L. W. Page, director, Office of Public Roads, U. S. Department of Agriculture, recently presented a paper before the Franklin Institute, which contains some essential details pertaining to the construction of war roads:

The design for highway improvements under ordinary conditions is not beyond a reasonable determination after a careful study of the traffic by means of traffic census and knowledge of the country to be served. The destiny of traffic under peace conditions never can equal that flowing from the demands of war, and any attempt to meet the possible military demands on all roads would result in a breakdown of the highway policy when considered from no other than an economical standpoint. For example the Bar-le-Duc-Verdun road in France, about 50 miles in length, was forced to carry, during the months of the attack on Verdun, a continuous line of five thousand motor trucks throughout the day and night. Traffic moved in four lines along the highway, the speed of the vehicles varying with the line in which they travelled. Slow-moving horse-drawn vehicles moved along the shoulders, and the trucks moved at about a rate of twelve miles an hour, spaced fifty feet apart, with breaks of one hundred to two hundred feet now and then to allow for high-speed vehicles to shunt into line on passing the usual trains of trucks.

The construction of roads to carry such traffic is only advisable where it appears from the best military information that a similarly congested traffic might be likely to develop in certain very limited areas. For instance, as a part of the general network of roads already described certain sections from important railroad centres in the middle Connecticut Valley, the upper Hudson Valley, and the middle Susquehanna Valley might be constructed to take such traffic as the Bar-le-Duc-Verdun road carried to within easy striking distance of Boston, New York, and Philedalphia. But the mere statement of such a decision is open at once to the reply that to meet the possible needs practically any road in the system might become subject to the unusual conditions.

We are thrown back, then, in our detailed location and design very largely upon the same considerations as control highway construction in times of peace.

The military road should therefore be the most economical one, just as in the case of the selection under peace conditions; and, except in cases of emergency, the usual factors will apply. The most economical highway under all conditions is the one which results in the longest life for the amount of money invested and that serves its traffic with ease and safety. It is seen that the demands of traffic are the underlying basis of consideration for the improvement of any road and in turn govern the physical construction through the factors of location, character of improvement, type and width of surfacing, alignment, grade, etc. In general, a military road should be designed to carry traffic without delay or confusion, and with a minimum of effort.

Considerations of engineering location are controlled by the same details as for ordinary highway construction. A slight adjustment of some of our assumptions of design should be made. Grades should not exceed five per cent., except that an emergency maximum up to ten percent. for not more than fifty yards may be allowed. Alignment should have no curves with radius less than two hundred feet, and a vista of not less than three hundred feet. The road foundations and bridge structures should be designed and built to carry at least six thousand pounds forward and eight thousand pounds rearward on a wheel base of 10 x 5 feet. The paved surface should be twenty feet wide and the grade thirty feet wide.

It is seen at once that, with the exception of the last, such requirements are warranted economical in time of peace only on a coarse network of important intercity roads such as that already outlined.

On the large coastwise net and through routes to the interior developments could, of course, continue as traffic demands increased. States having funds could fill in the net with smaller meshes, and the same requirements of design should ultimately apply to these as apply to the ordinary strands of the net, although a lower standard of design might at first be adopted. In many of our states such developments already exist.

Much has been said lately of materials and methods of construction. It appears, from the most reliable and first-hand sources of information, that water-bound macadam, telford, V-drains, and stone base are the most effective purely military types of construction. We know that such type is not economical in many localities under circumstances of a piping peace. For this reason the type selected for use in our suggested system may be in accordance with current economic rather than possible military demands. But it is to be remembered that a requirement of maintenance controls under actual fighting conditions. Repairs must be made easily, rapidly, and without in the least interrupting or diverting traffic. The traffic carried by the Bar-le-Duc-Verdun road was astounding in its wear and could not be halted. The question of restoration of road surface called for much ingenuity, and was a matter of extreme expediency. Just what our American higher types of pavement would have suffered is hard to determine, as none of them are found to any great extent in the European zones of activity. Many of them would doubtless stand heavy pounding for a longer time than the macadam, but when rupture came the invariable requirement of immediate repair would force resort to materials and methods capable of rapid and effective application.

Macadam Generally Used.

The records furnished us so far indicate that water bound or clay bound macadam has been generally used by the French and English immediately behind the Western Front. In the accounts, however, little differentiation has been made between the roads actually wthin the range of shell-fire, in what might be called the battle area, and those to the rear. It seems most likely that American practice can develop an improvement over the water-bound macadam patching in both areas, more especially on the main roads beyond range of shells. The advance that we have made in the last five years in the development of cold patch materials and their use indicates the great possibilities in this direction.

This method can be used on almost any type of wearing surface, from ordinary water-bound macadam to concrete or brick. So, if we have any given system of roads constructed to meet the demands of normal traffic in times of peace, these roads may be repaired either with cold patches or water-bound patches if they ever come within the range of hostile artillery.

Roads built or rebuilt as the immediate accessories of an advance must be of materials that consolidate and furnish a travelled way in the least time. Such roads will probably be found in water-bound macadam or gravel. Likewise the repair of these roads, so long as they remain a part of the battle area, will have to continue in part of this type, or perhaps, under some conditions, of cold patch materials.

In this connection it is interesting to note that, when the War Department began the enormous task of building the National Army cantonments, a considerable mileage of camp roads and streets became necessary. The general opinion of those having the matter in charge was quite uniformly in favor of placing a gravel or macadam base at once wherever such materials were available. There were only a few exceptions to this plan in actual construction. The reason for this opinion was obviously that such types could be built most rapidly, and the same day a hundred feet of road was laid it could be used. Further, such construction would serve adequately as a foundation for any topping or surface treatment that might later be considered necessary. In fact, there has been considerable surface treatment, some bituminous macadam, in one or two cases bituminous concrete, and rather generally concrete platforms at warehouses constructed in the several cantonments. The company streets have generally been left as gravel or macadam.

These plans were arrived at independently of any information from the fighting front, as information was not then available. The decisions were reached solely upon a common-sense consideration of the highway problem.

Departure from Usual Method.

The result of a departure from this general solution of the cantonment road problem is seen in detail in the work being done at Quantico, in Virginia. There it was decided to use concrete. At one time a daily rate of construction of five hundred linear feet of fifteen-foot road was reached by a single mixing plant. This is a rate of about three miles per month. But even this rate was not sufficient to enable completion of the work during the summer and fall. To continue operations into the winter it has become necessary to adopt expensive and unusual methods in order to insure the pavement against freezing and consequent serious damage. The blocks as laid are covered first by a frame-work of wooden slats; over this is spread a three-ply canvas tarpaulin. A layer of straw and stable refuse is spread on this, and the road remains thus covered about ten days to two weeks. It is necessary also, to heat both the sand and large aggregate, and this is done by placing through the piles of materials metal cylinders in which fires are built. In addition, the water for gauging the concrete is heated before use and thus the temperature of the entire mass is kept above the freezing-point until the block is poured and covered with the protecting canvas and straw mat. Of course, these precautions have materially reduced the rate of construction.

Under circumstances like these, which can occur in any latitude north of 33 degrees, and should be confidently expected anywhere north of 36 degrees, it is seen at once that the exigencies of rapid construction, immediate serviceability, and simplicity of method and materials throw us back upon the lower rather than the higher types of road surfacing.

Naturally these observations raise the question of costs. It has been stated in a reliable account that from ten to twelve thousand men have been used in one road organization on the British front in Flanders, that four thousand men were at one time on a single mile, and that stone has cost as much as $7.50 per cubic yard. The only statement pertinent is that cost is not considered. Much work is done by hand on the Western front, however, that by American methods might and probably would be done by machinery.

Shell Holes, Repairs and Camouflage.

The question of shell holes is interesting, but the destruction from this cause is, according to the best information, much less in general than the layman supposes. Shells that bury themselves in loose earth before exploding burst almost at contact with a hard road surface and expend much of their force in the direction of least resistance. Consequently, shell holes on the roads are much shallower and smaller than in the fields. Moreover, it is costly business wasting ammunition in indiscriminate shelling of roads. Such destruction as occurs is usually the result of attempts to destroy motor trains or other transports passing over the roads, and is concentrated over a very limited length. Attempts to cut a road by shell fire are usually directed at points where aeroplane photographs indicate cuts or fills. The shelling aims to blow in the cut or blow out the fill. As a matter of fact, there appears to be little shelling of roads merely as such.

For these reasons the large bulk of repair work is the replacing of worn or scattered road metal. There appears to be nothing unusual in the methods used to make these replacements. A roller cannot commonly be used until the congestion of traffic is reduced so that it can be thrown on one-half of the road surface. Then the rollers are put on and the surface thoroughly repaired. Roads that have been gradually brought out of the battle zone by advancing forces are at the earliest moment practically rebuilt, being put into a condition as good as new, according to the reports at hand. If the same series of events occurred in the United States it appears probable that, with the persistence of heavy traffic even after the road has passed beyond shell fire, its reconstruction would have to be rapid and and so conducted as to cause a minimum interference with traffic. For this reason it appears most probable that, regardless of original type, such reconstruction would quite generally be of gravel or macadam, at least until the fighting passed entirely out of the region tributary to the road.

We have no data that will lead to a choice of materials with respect to an effort to produce the effect of "camouflage." The French engineers have generally given up attempts to disguise a highway. The reason for this is rather obvious. The enemy locates these roads in the first instance from maps secured in time of peace. He corroborates his evidence by photographs taken from obesrvation balloons or aeroplanes. The reflection of light from the regular road surface produces a road in the picture regardless of the color of the surface. The road always appears in the photograph in plain contrast with the surrounding terrain, from which the reflection is irregular. The local attempts at camouflage are now confined to the distribution of branches or brush so as to cast irregular shadows across the surface.

In this connection a detail of importance appears to be the suppression of dust. Although the roads are not gratuitously and promiscuously shelled they are watched, and if a cloud of rising dust indicates the passage of a support train or ambulance, that cloud at once becomes a target. The use of light oils or othetr familiar dust palliatives is of advantage. This also reduces the chance of accident from driving into a fog of dust.

A Remarkable Pile Driving Record

At present a considerable amount of attention has been turned to records made in various phases of ship construction. While high records are interesting, yet it is the steady high average that counts, and not the one day's performance of an individual workman. Not only have high averages been made in riveting, but the following performance by the Raymond Concrete Pile Company, of New York, possibly creates a record of speed in driving long wooden piles at the Hog Island shipyards:—

The piles, averaging nearly 63 feet long, had an aggregate penetration of 10,257 feet in mud, earth, clay and gravel. The tips were slightly pointed with an axe, and they were capped with a steel plate and driven without follower by a No. 1 Raymond steam hammer with a 5,000-pound striking part delivering about fifty-five 3-foot blows a minute. The hammer was operated in a 26 by 60-foot, 30,000-pound wood frame land machine, with leads about 70 feet high. The machine, equipped with a Lidgerwood hoisting engine, is mounted on two traveling carriages with double-flanged wheels running on standard railroad rail. These carriages run at right angles to each other and thus the pile driver is able to cover the entire area over which the tracks are laid.

The machine was operated by a gang of 12 men, an engineer and a fireman, under the direction of Captain Sutton. A sufficient number of piles were distributed on the round near the site where they were to be driven, were headed, capped, dragged to the machine and hoisted by the usual whip line, and were rapidly spotted by longitudinal and transverse sights fastened to the track supports to be located, thus locating them without measurement.

Mr. Thomas Linsey Crossley, who was formerly connected with the laboratory of Dr. J. T. Donald, Montreal and Toronto, has joined the staff of the Wayagamack Pulp & Paper Company (chemical section), Three Rivers, P.Q. Mr. Crossley has done a large amount of work in the testing of asphalt.

Fuel Economy in the Operation of Hand Fired Power Plants[*]

THE combustion of coal in a furnace is essentially a chemical process. The combustible in coal consists of carbon,[1] hydrogen and sulphur. During the progress of combustion these elements unite with oxygen to form carbon dioxide, steam, and sulphur dioxide respectively. The air, which furnishes the oxygen for this process, consists of a mixture of 21 per cent by volume of oxygen and 79 per cent of nitrogen. Oxygen is the active element as effecting combustion, the nitrogen being inert and taking no part in the process.

When combustion takes place, heat is given off. For every pound of carbon burned to carbon dioxide, 14,600 B.t.u. are released. In the same way, for every pound of hydrogen burned to water vapor 62,100 B.t.u. are liberated. One pound of sulphur in burning to sulphur dioxide gives up 4,000 B.t.u. The heat liberated serves to raise the temperature of the fuel bed, of the surrounding surfaces, and of the products of combustion. Part of the heat delivered to the water in the boiler is transmitted by direct radiation from the hot surfaces, and the rest is absorbed by conduction from the gases, thus lowering their temperature. The heat carried away by the gases after they have left the heating surfaces of the boiler represents the loss entailed in the process. The extent of this loss is, of course, indicated by the temperature of the gases leaving the heating surfaces. The nitrogen, as stated, takes no part in combustion, but on the contrary it absorbs a certain amount of heat in having its temperature raised from that of the air to that of the gases leaving the fire. Consequently, the temperature of the other gases does not reach so high a point as would be possible if oxygen alone could be introduced into the fuel bed. When the nitrogen leaves the heating surfaces with the rest of the gases, it carries away part of the heat released by the fuel, and, therefore, represents loss. This loss amounts to about 0.24 B.t.u. per pound of nitrogen per degree F.

In the process of combustion, one pound of carbon unites with 2.67 pounds of oxygen to form 3.67 pounds of carbon dioxide. Since the composition of the air is 77 per cent nitrogen and 23 per cent oxygen by weight, 2.67 pounds of oxygen requires 11.6 pounds of air.

One pound of hydrogen in burning unites with eight pounds of oxygen to form nine pounds of water vapor. In this case the amount of air required is 34.8 pounds.

One pound of sulphur in burning unites with one pound of oxygen to form two pounds of sulphur dioxide. The air required is 4.35 pounds.

It is evident that if the weights of carbon, hydrogen, and sulphur in one pound of coal are known, the air necessary to burn completely one pound of coal amounts to 11.60 times the weight of carbon, plus 34.80 times the weight of hydrogen, plus 4.35 times the weight of sulphur. This is about 12 pounds of air per pound of coal[2].

Every cubic foot of oxygen used in the combustion of carbon is replaced by one cubic foot of carbon dioxide. For this reason, the percentage by volume of CO_2 in the flue gas is an indication of the amount of excess air present in the furnace. A given amount of CO_2 will be formed for every pound of carbon burned. If just enough air is used for the complete combusion of the carbon, the oxygen will be replaced by the CO_2 formed and the latter will be the same percentage, by volume, of the mixture as the original oxygen. If twice as much air as necessary is used, the same volume of CO_2 will be formed as before, but this will replace only one half of the oxygen used, and hence its percentage of the mixture will be only half as great as in the former case. These relations are somewhat affected by the fact that hydrogen and sulphur are present, but their amounts are too small to have an important bearing on the result.

If less than enough air is furnished for complete combustion, part of the carbon in the coal, instead of being burned to carbon dioxide, will form carbon monoxide. Under these circumstances the amount of heat liberated per pound of carbon, instead of being 14,600 B.t.u. will be only 4,500 B.t.u. The difference, 10,100 B.t.u., will represent the heat lost for every pound of carbon burned to carbon monoxide.

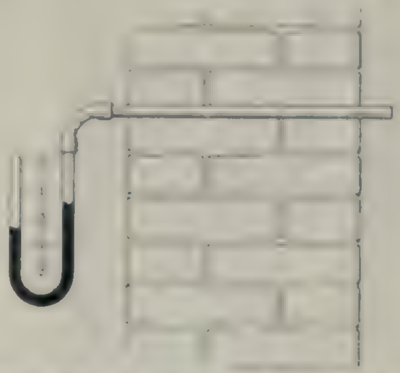


Fig. 1—Manometer tube for showing the difference in pressure between the outside and inside of a boiler wall

Since combustion is the result of the union of oxygen with the varions elements in the coal, and with the combustible products formed in the fuel bed, it necessarily follows that in order to have complete combustion, each particle of these elements must come into contact with a sufficient amount of oxygen. To insure this contact between the particles of the combustible and oxygen, it is necessary to supply an amount of oxygen, and hence of air, somewhat in excess of the amount theoretically required, otherwise carbon monoxide will be found in the escaping gases. This excess acts as a further diluent, and represents loss, just as the nitrogen in the air represents loss. A compromise must, therefore, be made. The correct amount of air to be used is obtained when the loss due to heating the excess just balances the loss due to the carbon monoxide appearing if the excess is reduced. For best operating conditions it is found necessary to use between 30 and 40 per cent of excess air.

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[*] From University of Illinois Bulletin.

[1] The chemical symbols used for these elements and compounds are as follows: Carbon (C), hydrogen (H), sulphur (S), oxygen (O), carbon dioxide (CO_2), steam (H_2O), sulphur dioxide (SO_2), nitrogen (N), and carbon monoxide (CO). Carbon dioxide is variously known as carbonic acid gas and as black damp, while carbon monoxide is known as carbonic oxide and as white damp.

[2] Any air above the chemical requirement for complete combustion is known as excess air.

Before the union of oxygen and the elements in the coal can take place with sufficient rapidity to be of any practical use, it is necessary that the whole mass be brought to a temperature known as the ignition temperature. If, because of any condition, such as contact with the cold surfaces of the tubes or the inrush of an excessive amount of cold air, the temperature of the gases is lowered below the ignition point before combustion is complete, combustion will cease and part of the fuel will escape from the furnace unburned. This, of course, represents a loss.

The three fundamental conditions necessary for complete and smokeless combustion may now be stated as follows:

(1) A sufficient amount of air must be supplied.
(2) The air and fuel must be intimately mixed.
(3) The mixture must be brought to the ignition temperature and maintained at this temperature until combustion is complete.

Significance of Draft.

The technical meaning of the term "draft" does not refer to the motion of the air or gases, but merely defines the difference in pressure existing between the air outside and the gases inside the furnace (See Fig. 1.) If there is an opening into the furnace and the draft is maintained, air will be forced in from the outside. The amount of air which passes will depend upon the size of the opening and the resistance offered to the flow; hence the weight of air passing through the fuel bed from the ash-pit for any given draft over the fire will depend upon the thickness of the bed, the size of the pieces of coal, and the condition of the bed. In any case, the combustion of a given amount of coal always requires a definite amount of air. Since for large pieces of coal the voids in the fuel bed are correspondingly large, a fuel bed of given thickness will present less resistance to the passage of air than a bed of finer coal of the same thickness. Hence it requires less draft with large coal than with fine coal to pass a given amount of air through the fuel bed. It is, however, advisable to use a thicker bed with large coal in order to close up the holes. This in turn will make it necessary to increase the draft to a point about equal to that used for fine coal, although the exact relation existing between thicknesses of bed, draft, and load on boilers must be determined by experiment in each case.

In view of facts developed in a recent investigation,[3] special attention should be given to the regulation of the overdraft in hand fired furnaces, since, contrary to the generally accepted belief, it is shown that most of the excess air is admitted into the combustion chamber above the fuel bed instead of through the fuel bed.

Every boiler should be equipped with two draft gauges, one connected directly into the space over the fire (Fig. 2), and one connected both into the space over the fire and into the gas passage below the damper, giving the drop in pressure through the tubes and baffling. The operation of the boilers should be controlled by means of the draft over the fire. The draft necessary to carry any given load and the corresponding proper thickness of fuel bed with the grade of coal used should be determined. With everything in good shape and no leaks in the setting and a given draft over the fire, there should be a definite loss of draft through the setting, or differential draft as it will hereinafter be called. When the damper is opened to increase capacity, both the furnace draft and the differential draft will increase. Assuming that the correct thickness of fuel bed is being used, an increase in the differential draft reading over the normal reading with the given furnace draft indicates that there are holes in the fuel bed or that the tubes have become clogged with soot and ash. A decrease in the differential draft indicates that the fuel bed is dirty and that the resistance is greatly increased by ash or clinker, or that some of the baffling is down, causing a short circuit of the gases.

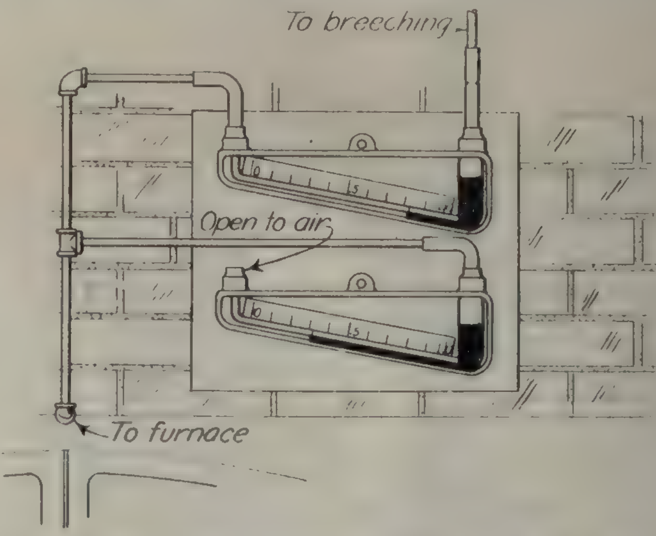

Fig. 2—Sketch showing correct method of connecting draft gauges

CO_2 in the Flue Gases.

A study of the amount of carbon dioxide (CO_2) in the flue gases affords the only practical means of obtaining a knowledge of conditions existing within the furnace on the basis of which correction or regulation to obtain the best results may be made. The importance of making CO_2 determinations, therefore, warrants a discussion of the methods by which these determinations may be made. Every plant should be equipped with some form of CO_2 analyzing apparatus and the fireman or other employee taught to use it. Since it is comparatively inexpensive, the outlay will be returned many times by the gain in efficiency and the consequent saving of fuel. For this purpose an Orsat apparatus or some of its modified forms should be used. The complete Orsat apparatus provides a means of analyzing for carbon dioxide, oxygen, and carbon monoxide, but since the CO_2 values give a sufficiently accurate indication of the amount of excess air passing through the fire, the analysis for the other two gases may be omitted and the apparatus used in its simplest form, as shown in Fig. 3. This consists merely of a pipette, h, to hold the solution (potassium hydroxide), a measuring burette, e, of 100 cubic centimetres capacity, a levelling bottle, f, containing water, and an aspirating bulb, m. The solution may be made by mixing equal weights of potassium hydroxide (KOH) and water. In the absence of this chemical, concentrated lye may be used.

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[3] "Combustion in the Fuel Bed of Hand Fired Furnaces," by Henry Kreisinger, F. K. Ovitz and C. E. Augustine, Tech. Paper No. 137, U. S. Bureau of Mines, Washington, D.C. The investigation reported in this publication discloses the following facts: "The current of air in passing through a uniform fuel bed without holes will have all its oxygen used within the first four inches from the grate. The rate of combustion therefore varies directly with the rate at which air is forced through a uniform fuel bed. The completeness of combustion is determined by mixing volatile gases with air in the space above the fuel bed. The reactions here are between two gases rather than between a solid and a gas, and the space required for this process is much greater. If only the theoretical amount of air is here available, the mixing may not be sufficiently perfected before the gases have passed out of the combustion space. Hence it is necessary to supply an excess amount of air over the fuel bed. This air must be introduced through openings above the fuel bed or come in through holes in the fire.

In using the CO_2 apparatus, the liquid in the pipette, h, is first brought to the mark, o, just below the cock, d. This can be done by lowering the levelling bottle, f; after which the cock, d, should be closed. The 3-way cock, c, is then opened to the burette, e, and to b, and by raising the levelling bottle, f, the water in the burette is brought to the mark, g, and the cock, c, closed to the burette, and opened through a and b. The aspirating bulb, m, is now worked, drawing gas from the sample tube, n, in the setting and forcing it out through b. When sufficient gas has been forced through to clean out the air and dead gas from the sample tube, the cock, c, is turned so that b is closed, and a is in communication with the burette, e. The sample is then pumped into the burette, thus driving the water into the levelling bottle and more than filling the burette. The levelling bottle is then raised until the water in the burette stands exactly at 100 cc., the rubber tubing between the levelling bottle and the burette is clamped between the thumb and finger so that no change in the level at 100 cc. can take place and the cock, c, momentarily opened to the atmosphere through b and then closed to the burette. If this has been done correctly, when the two surfaces, e and f, are brought to the same level, e should stand at 100 cc. An alternate method of obtaining 100 cc. at atmospheric pressure is to have the 3-way cock open through a to c and closed to b. The gas may now be forced out through the liquid in the levelling bottle, f. The water at f and e may now be brought to the same level and the cock closed to the burette, e. The cock, d, is now opened and the gas driven into the pipette, h, by raising the levelling bottle. It should be driven back and forth between the burette and pipette several times, and then the liquid in the pipette brought back to the mark, o, and the cock, d, is closed. The surfaces, f and e, are again brought to the same level, and the amount of CO_2 in the gas sample is read from the burette at e. This operation is easily performed and a fireman of ordinary intelligence can analyze a sample in about two minutes.

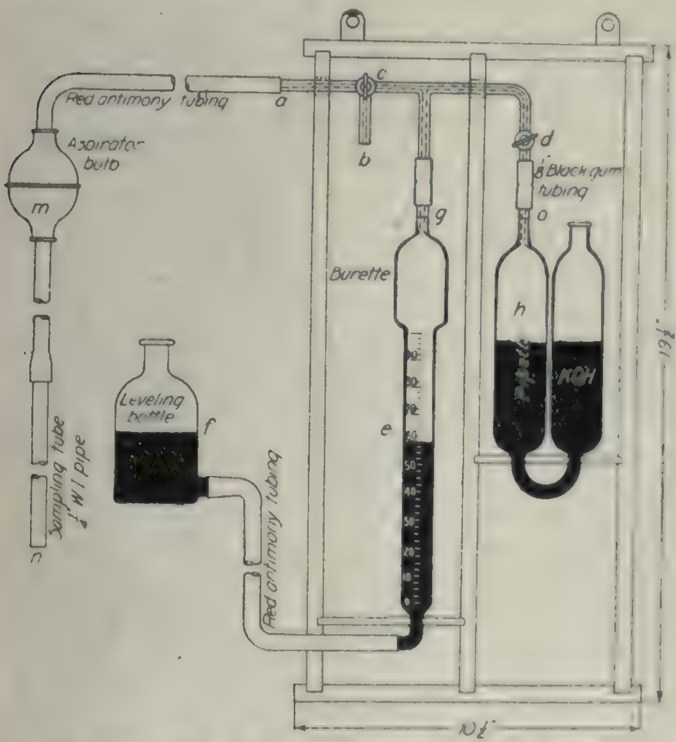


Fig. 3—Apparatus for the Determination of CO_2 in Flue Gas

Losses of Heat Value.

The losses in the boiler plant may be divided into two classes:

(1) Those due to the loss of green coal in handling
(2) Those resulting in the process of combustion.

Losses of the first class are usually small and easily detected; hence they will not be discussed further.

The principal losses are those entailed in the process of combustion. These may be divided into the following classes:

(1) Loss due to excess air and air leakage through the setting.
(2) Loss due to combustible ash.
(3) Loss due to CO_2 formed:
(4) Loss due to soot on the tubes.
(5) Loss due to moisture carried in with the coal and air.
(6) Loss due to heat carried out by the escaping gases.
(7) Loss due to radiation.

Losses included under classes 1 to 4, inclusive, are largely preventable, while those under classes 5, 6 and 7 are more or less inevitable, although they may be reduced to a minimum with proper care.

Excess Air and Air Leaks.

Losses due to excess air and to air leaks are discussed together because they may both be detected by the same means, i.e., by analysis of the flue gas. Under the head of excess air may be included all air which goes through the combustion zone in excess of the amount required for perfect combustion. Air leakage includes all air going through holes in the setting and other places besides the fuel bed.

The space inside the average boiler setting is at less than atmospheric pressure; hence if there are any openings in the setting, air will leak through from the outside. This cold air not only takes no part in the combustion, but its temperature must be raised to that of the rest of the gas, a process which requires heat and lowers the temperature of the other gases. Some of this heat is given back to the water in the boiler, but all that indicated by the difference between the temperature of the flue gas and that of the air in the boiler room represents a dead loss. This is also true of the excess air carried through the fuel bed While these losses cannot be detected with the naked eye, like that due to green coal in the ash, they are by far the most serious of all losses occurring in the average plant.

Leaks in the setting may occur in the metal work around doors and joints as well as in the brickwork When leaks are found they should not only be stopped with asbestos or stove putty, but should be calked with waste or asbestos fiber soaked with fireclay in such manner as to prevent cracking off or falling out as soon as dry. The last of the leaks may best be found by building a smoky fire and shutting the damper. Smoke may then be seen to issue wherever there is a leak When the setting has been made as tight as possible, air will still seep in because the bricks and the mortar are porous. This leakage may be reduced to a minimum by tacking metal lath to the setting and applying a coat of plaster one inch or so in thickness made of a mixture of about 80 per cent magnesia and 20 per cent old magnesia pipe covering. In order to secure a satisfactory surface 85 per cent magnesia should be mixed with cement to form a thin grout, spread on the surface, trowelled to a smooth finish, and painted. This makes a good lagging not affected by temperature changes and also serves to reduce the radiation loss listed under class (7). If the setting is too hot to permit touching it with the hand without discomfort, the radiation loss is excessive.

After the setting has been made absolutely tight it will pay to give attention to the excess air loss, but it is well to emphasize that the former should be done first. There exists a very definite relation between capacity, draft, fuel bed thickness, and air passing through the fuel bed with a given grade of coal. For Illinois coal a draft of approximately .01 inch of water is required to burn one pound of coal per square foot of grate surface per hour. This ratio is slightly increased for rates of combustion above twenty-five pounds of coal per square foot per hour.

In order to determine these relations in any given plant, a time should be chosen when the load on the boilers will remain constant for several hours. The fire should be clean, of uniform thickness, and free of holes, and the surfaces of the tubes should be free of soot. A draft and fuel bed thickness sufficient to maintain the load without loss of pressure should then be chosen. Simultaneous readings of the draft and analyses of the flue gas should now be made as rapidly as possible and repeated at brief intervals to insure permanence of conditions, and a watch should be kept on the fire to see that holes do not develop. Care must be taken not to open the furnace doors during a reading. Records should be kept of the drafts, CO_2, and fuel bed thickness. Thickness of fuel bed should then be varied and the draft adjusted to carry the load without pressure drop, or without blowing the safety valves. When sufficient time has elapsed to allow conditions to become constant, another set of readings should be taken. If too thin a fuel bed were used at the start, it will be found on comparing the readings that as the thickness of the fuel bed is increased, the draft increase and the percentage of CO_2 also increases. Finally a point will be reached at which the CO_2 does not increase further as the thickness of the fuel bed and the draft increase. The draft and fuel bed thickness to give this CO_2 reading represent the proper values for the given load on the boiler, under which the suggested changes in operating conditions have been made. This process should then be repeated for a number of different loads on the boiler. Upon doing this it will be found that with a given thickness of fuel bed, certain more or less well defined limits of draft over the fire will give a maximum CO_2 reading. The draft then becomes the key for controlling the whole situation. If the load on the boiler is such as to require drafts between certain limits, then the thickness of fire which should be used is immediately known, provided there are no holes in the fire and the tubes and fire are clean. These latter conditions will be indicated by the differential draft gauge, Fig. 4, readings of which should also have been taken during the tests when the tubes were known to be clean and the fire in good condition. A table or chart should be laid out for the use of the fireman, which, as soon as the approximate draft necessary to maintain boiler pressure is known, gives the thickness of fire to be carried and the corresponding differential draft gauge reading. If the furance draft and thickness of fire are correctly maintained and the differential is then too low, it indicates either that the fire is dirty or that some of the baffling has fallen. A too high reading of the differential indicates that there are holes in the fire, or that soot is clogging the passages through the tubes.

The thickness of the fire should not be left to the judgment of the fireman, but definite marks should be placed on the inside door liners, or at some points where they may be seen. In any case, it should be thoroughly understood that the cooperation of the fireman is necessary, and unless the fires are kept clean, and the firing is done in such a manner as to maintain a uniform fuel bed without holes the other precautions suggested are useless.

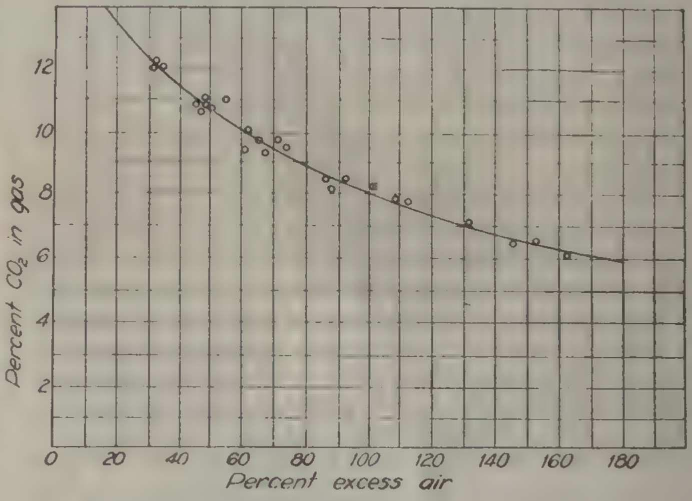


Fig. 4—Curve showing relation between excess air and CO_2 in flue gas

Since air leakage through the setting tends to increase as the draft increases, it is good policy to run on the minimum draft which will carry the load without pressure drop. The CO_2 readings are a direct indication of the total loss due to both excess air and to air leakage when taken just below the damper. A curve is presented in Fig. 4 which has been plotted from flue gas readings when burning Illinois slack on a chain grate. It gives the percentage of excess air represented by different percentages of CO_2 in the gas. From this curve it may be seen that 12 per cent of CO_2 represent about 35 per cent excess air. This is the maximum CO_2 reading obtainable with this coal when burned on grates of approximately 93 per cent grate efficiency without danger of incomplete combustion and a corresponding loss due to carbon monoxide. If this value is not exceeded, it will not be necessary to analyze for carbon monoxide and the determination for CO_2 is sufficient.

It has been mentioned in a preceding paragraph that the proper position for the sampling tube is at a point where the hot gases leave the heating surfaces for the last time. The reason for this may now be made clear. The CO_2 in the sample at this point is an indication of all the excess air and leakage which has diluted the gas and absorbed heat which should have gone into the water. After the gases leave the heating surfaces there is no longer any chance of heat being absorbed and it is not important, so far as efficiency is concerned whether it is lost in a small amount of gas at a high temperature, or in a large amount of air and gas at a lower temperature. Any air leakage beyond this point, therefore, does not lower the efficiency. The harmful effect, however, is shown on the capacity. It not only adds its own bulk to the gases the chimney must carry, but also, due to its cooling effect on the hot gases, lessens the draft available to produce the flow. In many cases the mere stopping of the leaks in setting and breeching has enabled boilers to carry overload, while previously it had been impossible to obtain rated capacity.

The draft should be controlled by means of the dampers at the flue, and not by the ashpit doors. Closing the ashpit doors prevents air from going through the fuel bed, causes clinker and hot grates and also increases the air leakage loss. Each boiler should be equipped with a separate damper and the position of maximum and minimum opening should be found by noting the reading of the draft gauge while the damper is moved from one extreme position to the other. These points of maximum and minimum draft gauge reading may not coincide with the points at which the damper is mechanically open or closed. A position will usually be found at which the draft is maximum, and a further opening of the damper will not change the reading. It may also be found that the damper can be opened quite appreciably before the draft gauge begins to read. In many plants of large and medium size automatic draft control has proved economical and it is also of advantage in maintaining constant steam pressure. If automatic control of the draft is used, it is important to have the damper adjusted for the range of travel determined by experiment as suggested, so that the draft will be proportional to the opening. An automatic damper regulator, when used, should preferably be of the type which responds to small decreases or increases in steam pressure by causing a corresponding movement of the damper and not of the type which either completely opens or completely closes the damper in response to small decreases or increases of pressure. If there are several boilers in the plant, the best plan is to adjust the individual dampers so that each boiler is carrying its share of the load under the most economical draft, and then, if the total load changes, to regulate with a master damper in the main flue.

Loss Due to the Presence of Combustible in the Ash.

The loss due to partly burned coal in the ash should not, with very careful handling of the fire, exceed more than about three per cent of the heat value of the coal. Excessive carbon in the ash with stoker fired furnaces usually indicates too rapid feed for the rate of combustion used. In hand fired furnaces it may indicate that the grate openings are too large for the size of coal used or that the fire is worked too much, or both. So far as possible the fire should be operated without much working except at times of cleaning. Too much working does two things; first, it shakes the green coal down into the ash and allows it to pass through the grate bars, and secondly, it brings the ash up into the hot part of the fire where it fuses and causes clinker. Partly burned coal is fused in with the clinker and is lost when the clinker is removed, and the coal which is shaken through the grates during the additional working required to remove the clinker adds further to the loss. The possible loss due to firing green coal into holes in the fire and thus permitting it to pass through the grate has not been considered in detail because it is obvious that the holes should be filled up by levelling the fire before adding a fresh charge of green coal. In working a fire, it should be sliced from the bottom in such a manner as to avoid or minimize the possibility of forcing ash up into the fuel bed. This applies to stoker firing as well as to hand firing.

Loss Due to the Presence of Carbon Monoxide in the Flue Gases.

Carbon monoxide is formed if too thick a fire or an insufficient draft is used. With central bituminous coals there is little possibility of large loss from this source if the CO_2 reading is not more than 12 per cent.

Loss Due to Soot.

The largest part of the loss due to smoke does not result from the fact that the particles of carbon floating in the gas stream have passed out before giving up their heat value, but it comes from the deposit of soot on the tubes. The actual heat value of this deposit of soot is small when compared with the amount of coal fired in producing it, but its power of preventing the heat in the gases from reaching the tubes and being absorbed is a factor of considerable importance. Soot makes an excellent heat insulator, about five times as effective as asbestos. Under normal conditions and with the normal amount of air, the temperature of the gases leaving the boiler should be somewhere near 550 degrees F. If they leave at a much higher temperature and the fire and drafts are normal, it signifies that the tubes need blowing. The soot deposited on the heating surfaces is keeping the heat in the gas from reaching the water and the gases consequently are not cooled. Where automatic blowers are installed the tubes should be blown every four or five hours. In all cases they should be blown at least once for every shift. A pyrometer placed at the point where the gases leave the tubes for the last time will give a fairly good indication of their condition, provided of course that low temperature is not due to excess air.

Loss Due to Moisture in the Coal and Air.

The loss due to moisture in the air is very small, and need not be considered. That due to moisture in the coal may be larger. The coal may carry 13 or 14 per cent of moisture, and the heat required to evaporate this must be furnished by the coal itself, thus decreasing the amount available to heat water in the boiler. Fine coal tends to pack if fired dry. This prevents the proper amount of air getting to the fuel, and results in the formation of carbon monoxide and in cold fires. Sometimes very dry coal burns out unevenly, and will not stay on the grates without allowing holes to form. For these reasons, it is advisable to wet down the smaller sizes of coal just before firing because the other losses mentioned are greater than that due to the water. With larger sizes wetting is not necessary and is not advisable. This, however, must be decided for each individual plant. In no case should more water be added than is absolutely necessary.

Loss Due to Heat in the Escaping Gases.

Every pound of flue gas passing up the stack represents a loss of about .24 heat units per degree F. above the temperature of the steam in the boiler. This loss cannot be entirely eliminated. For plants operating on natural draft, a temperature of about 500 degrees F. is required in the stack to produce the draft necessary to operate the boilers at full capacity. An average of 550 degrees F. is good practice. For forced draft and four-pass boilers, it may run lower than this temperature. An indicating pyrometer should be used on each boiler and if the temperature in the flue becomes abnormally high it may be accepted as an indication of an excessive deposit of soot upon the tubes or of a draft greater than is necessary for the load.

Practical Hints for the Contractor

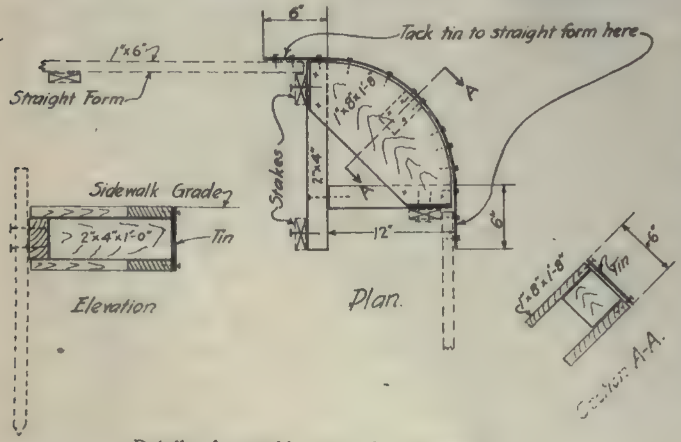
that may save him time and money. If you know any labor-saving scheme, send it in—preferably with illustrations. We will pay for all accepted articles.

Steam Hammer Suspended from Boom of Dredge Drives Sheet Piling

CONDITIONS sometimes arise which require a considerable amount of inventive ability on the part of the contractor in order to devise some means of meeting an unforseen difficulty. Often it becomes necessary to use certain parts of a machine independently of the machine itself. In some recent cofferdam work, where sheet piling was being driven by a floating steam hammer pile driver, the steam hammer was detached from the driver and used on the boom of a floating excavator for the following reason: After the piles were driven and the excavator had done considerable filling in around the piles, the pile wall gave way. It was impossible to bring up the pile driver near enough to the dam to renew the driving because of the filling in which had been made. As the boom of the excavator overhung the piling the steam hammer was detached from its frame and suspended from the boom of the excavator; guide lines were then run out from the hammer, being held by men stationed around the piling on shore. The piles were then placed by ropes from the boom and the hammer lowered on the piles, successfully sinking them to the required depth.

A Form for Sidewalk Corner

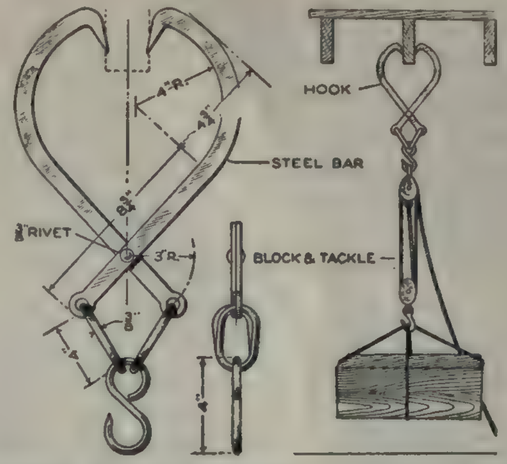
In order to increase the speed of pouring concrete in sidewalks where the small radii of the corner curves are the most tedious part of the work, a form, shown in the cut, which is described by J. L. Cozzens in the Concrete Magazine, is well adapted for this class of work. It is made up of rough material of almost any kind and each corner form may be taken up when the concrete has set and used again. The form consists of two pieces of 2 in. x 4 in. stuff carrying two boards whose outer edges are cut to the shape of the desired curve for the walk. A piece of tin or sheet iron is nailed to these edges of the boards to form the curve of the form.



Details of re-usable corner for sidewalk forms.

A Detachable Hoisting Hook

As an aid in moving heavy material in a building either during or after construction, the hook shown in the cut and described in 'Popular Mechnics' may be used to advantage. It somewhat resembles an ice hook and may be attached to a rafter or beam, the heavier the weight the tighter the grip. The capacity is only limited by the strength of the supporting member, and that of the material in the hook; which may be made as heavy as is justified for portability and the class of material to be hoisted. The dimensions of the hook shown are designed for comparatively light loads:



Portable hoisting hook for use where there are overhead beams and rafters

New Book

Powdered Coal as a Fuel—by C. F. Herington, mechanical engineer; D. Van Nostrand Co., New York, publishers; price, $3.00. The use of coal in powdered form is attracting the attention of industries and engineers throughout this continent. The fuel difficulties in Canada are largely matters of transportation and quite recently a prominent engineer prophesied that within ten years we should see powdered coal distributed to great distances in air pressure pipes. The present book deals with the subject under the following chapter headings: Coals suitable for powdering; preparation of powdered coal; feeding and burning powdered coal; powdered coal in the cement industry; application of powdered coal to reverberatory furnaces; powdered coal in metallurgical furnaces; powdered coal under boilers; powdered coal for locomotives; explosions. There are 77 illustrations; 200 pages, approximately 6 x 9 in.

Mr. Edward Frederick Fauquier, railway contractor and builder, who died at his home in Ottawa, on May 5, last, left an estate valued at $862.924. Most of this estate goes to his widow.

Mainly Constructional

East and West—From Coast to Coast

The Paving & Mastic Company, Limited, Toronto, has been incorporated with a capital of $40,000.

The city council of St. Catharines, Ont., will send a delegation to wait on the Provincial Minister of Highways and the Cabinet in Toronto to urge that the Q. & G. road be designated as a provincial highway.

Hiram Walker & Sons, distillers, Walkerville, Ont., have formed a company for the manufacture of aniline and other dyes, and propose shortly to commence the erection of a $1,000,000 plant. They also plan to build a factory at Walkerville to manufacture toluol.

Returning recently from a tour of inspection, Hon. P. J. Venoit, provincial Minister of Public Works for New Brunswick, stated that all work done on the highways of the province last year by the Department of Public Works has stood up well and is perfectly satisfactory.

The board of control of Hamilton, Ont., have recommended the issuance of debentures approximating $300,000 to cover the erection of the first wing of the technical school on Wentworth Street to cost $100,000, and a new 24-room school on the recently acquired Children's home property.

Rapid progress has been made on the erection of the new mill for the Timberland Company at South Westminster, B.C., beside the Fraser River, and the main building is now well advanced. This plant will be equipped with the latest labor-saving machinery and will operate to the capacity of 100,000 feet per day.

Rapid headway has been made on the construction of the new units of the sanatorium at Fort Qu'Appelle, Sask., for which the Poole Construction Company have the contract. Work was started on May 20 and the excavation work was completed in less than a month. An infirmary and several smaller buildings are being built.

Plan No. 1 for the new market building in Hamilton, Ont., is recommended for submission to the people next January. This provides for the erection of a one-storey building, with a refrigerating plant, at a cost of $105,000. Plans Nos. 2 and 3 were each more expensive, the former calling for a two-storey building, and the latter, a two-storey and basement structure.

To remedy the housing shortage in Guelph, Ont., a proposition has been presented to a company of leading business men which provides for the immediate erection of fifty dwellings. These are to be disposed of to workmen at cost, and it is stated that the expenditure on some of the dwellings can be held down to $1,600 each, or $2,600 for the semi-detached type. The work is to commence at once under the auspices of the Guelph Home Builders' Association.

Since the establishment of the aviation camp at Beamsville, Ont., tourist traffic over the Niagara district roads has been greatly increased, and there is also considerable freight traffic to the aerodrome. As their roads are thus being cut up by other than domestic traffic, the residents of the district feel that they should have government assistance for their maintenance and a delegation recently interviewed the provincial authorities in Toronto with a view to having the Hamilton-Frontier road designated as a provincial highway.

The municipalities along the route of the proposed Hull-Montreal highway are enthusiastically in favor of the construction of this road, and at a recent meeting held at the Angers' town hall, the 200 representatives present adopted a resolution, pledging each municipality to abide by the law governing state roads of the province of Quebec. Hon. Mr. Tessier, member of the provincial cabinet, made a promise to the effect that as soon as the various municipalities voted the necessary by-laws work would be started on the highway.

Members of the board of control, suburban areas commission, town planning commission and board of trade of the city of Hamilton, Ont., at a recent meeting went on record as favoring the construction of a bridge at the local end of the Toronto-Hamilton Highway, in preference to a fill. There is no intention of beginning construction until conditions become more normal, but the highway commission insisted that the city state definitely what its wishes were. Plans prepared by Engineer J. J. Mackay, which called for a bridge of concrete construction, were favored, but not definitely decided upon, consideration of costs and design is to be left until a future meeting.

The proposal to establish a provincial highway from Ottawa to Pembroke was the subject of discussion at a recent meeting of the Renfrew county council. A year ago the portion of this road falling within the county was included in the county system, and the councillors are now in favor of a provincial highway and the suggestion is advanced that the Dominion Government also would be naturally interested in the construction of a military highway to Petawawa Camp and would therefore contribute proportionally to its construction. Mr. R. J. McQuigge, of Arnprior, has been canvassing the situation in Pembroke, Renfrew, Arnprior and other district centres, and will visit Ottawa to confer with the Good Roads Committee lately organized there, and afterwards will lay before the Deputy Minister of Highways in Toronto the results of his efforts.

Tenders called by Halifax Shipyards, Limited, up to July 3 in connection with their proposed shipbuilding plant at Halifax, N.S., include the following works: (1) The piling and grading of three shipways, each 530 feet in length; (2) the excavating, filling and grading of shipyard for buildings, tracks and storage; (3) excavation for Canadian Government Railway relocation and grading, track laying and ballasting of same equal to about one mile of double track railway; (4) construction of 580 feet of concrete sea wall and back filling same; (5) construction of reinforced concrete retaining wall along right of way or railway relocation; (6) extensions to sewers, water mains, etc. The work will require approximately 270 cubic yards of earth and rock, dry excavation, and 20,000 cubic yards of concrete. Operations are to commence at once and if present plans are realized the keels of three 10,000-ton freighters, the largest ever built in Canada, will have been laid on the berths within three months.

Hon. Finlay Macdiarmid, Minister of Public Works for the Province of Ontario, has formally designated the Prescott-Ottawa and Port Hope to Quebec roads as provincial highways, and it is expected that improvement work will be immediately undertaken. Just how far operations can be carried during the war is not as yet determined. The greater part of the work, it is understood, will be on the Prescott Road. Last year permanent culverts were installed on the Port Hope road and the road surface improved by the cutting of side drains and spreading of gravel. Other roads designated as provincial-county roads are as follows: Owen Sound to Collingwood, via Meaford and Thornbury; also that portion of the road from the county line to Collingwood and on to Barrie, the Toronto-Sydenham road from Chatsworth to the county border southeast of Dundalk; the Garafraxa road from Owen Sound to Mount Forest, and the continuation of this road through Arthur and Fergus to Guelph, the road south of Dundalk through Corbetton, Shelburne and Orangeville to Port Credit.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Canterbury Station, N.B.
Tenders will be received until July 10 for the construction of a concrete arch culvert and roadway embankments for the Department of Public Works, Provincial Government.

Halifax County, N. B.
The Provincial Government contemplate the construction of road improvements costing $9,000. Engineer, A. F. Yorston.

Shawenegan Falls, Que.
Tenders will be called about July 5 for the construction of a concrete pavement on Fifth Avenue from Tamarack Street to Station Street for the City Council. Clerk, J. E. Meunier.

York Township, Ont.
Township Council contemplates the construction of watermains on High St. and Kenwood Ave. at a cost of $11,500. Clerke, W. A. Clarke, 40 Jarvis St., Toronto.

CONTRACTS AWARDED.

Aylmer, Ont.
Willard Benner has the general contract for concrete concrete reservoir for Town Council.

Dereham Township, Ont.
The following contracts have been awarded by the Township Council for the construction of drains and cement abutments: Sanders drain, John Eden, care Township Clerk, W. B. Lane, Dorchester; Vincent drain, Carl Marane, care Township Clerk; abutments for 3rd. concrete bridge, A. L. Oatman, care Clerk.

Gladstone, Man.
P. LaCour, 389 Elgin Ave., Winnipeg, has the general contract for two concrete culverts for the Municipal Council.

New Glasgow, N. S.
Blanch Tarbot has the general contract for sewer for the Town Council.

Stellarton, N. S.
C. A. Mitchell, New Glasgow, has the general contract for extensions to waterworks system for the Township Council.

C. A. Mitchell, New Glasgow, has the general contract for sewerage system for Town Council.

Welland, Ont.
Somerville & Dilworth, 117 Merritt St., have the general contract for cement sidewalks for the City Council.

Woodworth, Man.
Wm. Newman & Co., care of Clerk, has the general contract for two culverts for the Municipal Council.

Railroads, Bridges and Wharves

New Glasgow, N.S.
Tenders will be called shortly for repairs, additions and alterations to railway station for the Canadian Government Railways, Ottawa. Associated Chief Engineer, W. A. Duff, Ocean Terminals, Halifax.

CONTRACTS AWARDED.

Arran Township, Ont.
Hugh Watt, care Clerk H. T. Potts, Tara, has the general contract for rebuilding cement bridge "Sangs," costing $16,000, for the Township Counciil.

Cap De La Madeleine, Que.
Albert Veillet, St. Narcisse, has the general contract, grading and foundation work for $7,000, steel and concrete bridge over the Canadian Pacific Railway line for the Highways Department, Provincial Government.

Halifax, N.S.
Downing & Morrison, Linden St., have the general contract and C. R. Hoben, Granville St., the plumbing and heating for baggage and express building for the Canadian Government Railways, Ottawa.

Portage La Prairie, Man.
Wm. Newman & Co., care of Clerk, have the general contract for bridges for the Town Council.

St. Lawrence River, Ont.
Mr. Burningham, Kingston, has the general contract for rebuilding entrance to piers, locks No. 23 and No. 25 for the Department of Railways and Canals, Dominion Government.

Saskatchewan, Province of
Carter-Halls-Aldinger Co., 915 Union Bank Bldg., Winnipeg, have the general contract, masonry and carpentry, for addition to two roundhouses for the Grand Trunk Pacific Railway, Union Depot, Winnipeg.

Public Buildings, Churches and Schools

Burk's Falls, Ont.
The School Board contemplates the erection of a school. Secretary, A. H. Allman.

Cape Bauld, N.B.
Plans and specifications are with the architect, R. A. Frechette, 30 Bonnacord St., Moncton, who will recive tenders until July 15 for alterations costing $15,000 to church for the Catholic Church.

Estevan, Sask.
The Anglican congregation contemplate the erection of a $6,000, brick veneer church. Pastor, Rev. J. A. Swalwell.

Forestburg, Alta.
The Consolidated School District Board contemplate the erection of a $25,000 school. Chairman of Board, W. C. Banks.

Glace Bay, N.S.
The School Board contemplate the erection of a $5,000 school. Secretary, N. F. McNeill.

Halifax, N.S.
Tenders will be called shortly for the conversion of a building at Cheapside and Bedford Row into offices for the Provincial Government. Architect, W. J. Busch, 60 Bedford Row.

H. E. Gates, Queen Bldg., is preparing plans for alterations to interior of hospital for the Victoria General Hospital, Tower Bldg.

Hamilton, Ont.
The Board of Education contemplates the erection of a $200,000 public school on Main St. E. Chairman, Leemiing Carr, 415 King St. E.

The Board of Education contemplates the erection of a $120,000 technical school.

Lethbridge, Alta.
The City Council contemplate the erection of a small incinerator. Clerk, D. A. Duff.

Montreal, Que.
Tenders are in for the erection of a $200,000 Italian Church for the Parish of Notre Dame de la Defense. Architects, Montbriant & Nicheri, 230 St. Andre St.

Ottawa, Ont.
Tenders are being received by the architects, J. A. Pearson and J. O. Marchand, Centre Blk., until noon July 16 for interior doors, etc., required for the Parliament Buildings for the Department of Public Works, Dominion Government.

Geo. A. Crain, 285 Clemew Ave., has the general contract and will call tenders for plumbing, heating, plastering, painting and electrical work for $21,000 detention home for the City Council.

St. Francois D'Assise, Que.
Tenders are in for the foundation work for one storey granite and brick church for the Parish. Architect, J. S. Bergeron, St. John St., Quebec.

Todmorden, Ont.
The Don Mills Methodist Church contemplate the erection of parsonage. Pastor, Rev. D. D. Franks, 227 Don Mills Rd.

Toronto, Ont.
The Board of Education contemplate repairs to school. Secretary, W. C. Wilkinson, 155 College St.

The Board of Education will call tenders for the erection of a school. W. C. Wilkinson, 155 College St., is the secretary.

Tenders will be received until noon, July 11,by the secretary, R. C. Desroch-

ESTABLISHED 1886

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Poor Housing Accommodation Saps Workers' Efficiency

TORONTO'S Finance Commissioner, Mr. Thomas Bradshaw, has prepared a report on the housing situation in which he advocates the erection of houses by large company organizations for their employees. He suggests, in addition, that there is room for at least a dozen housing companies instead of there being only one—the Toronto Housing Company. It seems probable that the suggestion regarding companies caring for their own employees would go far toward solving the Toronto house problem, as much of the congestion is necessarily due to extra labor attracted to the city by munition and similar factories. The conditions under which many of these men live are very unfavorable, making it impossible to produce at highest efficiency and, at best, undermining the health of many of them. One case, not an isolated one, we believe, came to the attention of the writer a few days ago where a workman could only reach the factory in which he was employed by walking some three miles. This extra effort night and morning in all weathers added to a fearfully exhausting ten-hour day on heavy shell cases has already left this man little more than a wreck. In the days to come the few extra dollars he will have made as the result of his higher wages will be poor compensation for his lost physical fitness—all the more that this condition could be alleviated. It may be said that this man could find shelter nearer his work, but this is not so. As a matter of fact he pays fifteen dollars a month for a mere hovel—not a single convenience—and lives under the landlord's threat of a raise to twenty-five. In the interests of efficient war production and the conservation of our citizens' health, something should be done at once toward better and more convenient housing conditions.

Commercial Value of House Refuse

THE disposal of refuse has always been a tax on any community, whether large or small, for rarely has it been considered that the contents of refuse have any value. Few have cared to concern themselves with this material other than to get it out of sight in the shortest possible time, with the least expenditure. That refuse has a commercial value which may be utilized is shown by the following table obtained by the National Salvage Council of Great Britain:

Contents of Refuse.

	Per cent.	Tons	cwt	qrs	lb
Fine dust	56.8	5	14	3	0
½in. cinders	--	1	9	2	0
¾in. cinders	30.9	0	16	3	0
Large cinders	—	0	16	1	0
Bricks, pots, shale,&c	8.5	0	17	1	7
Tins....	1.0	0	2	0	10
Rags....	0.4	0	0	3	5
Glass	0.6	0	1	0	26
Bones	0.09	0	0	0	20
Vegetables	1.3	0	2	2	12
Scrap iron.	0.1	0	0	1	0
Shells..	0.08	0	0	0	18
Paper	0.06	0	0	0	14

It will be noticed that, with the possible exception of the fine dust, the whole of the ingredients have a definite commercial value at the present time, and what is particularly noteworthy is that not less than 30 per cent. of the material was found to consist of cinders, which, after very careful scientific examination, were proved to have a calorific value of over 9000 B.t.u's per lb. The calorific value of best steam coal is about 13,000 B.t.u's per lb. The fact that 30 per cent. of refuse has a calorific value almost equal to coal is sufficient to at once destroy the argument, too often used, that house refuse has no value. The percentage composition of refuse will, of course, vary in every town, but the above figures as regards an industrial town are particularly illuminating and indicate the prevalence of such serious waste that local authorities should bring to the notice of householders the necessity for the prevention of the waste of coal, and also take measures to profitably utilize the large quantities of cinders which are collected by them.

Re-establishing the Returned Soldier

AT a joint meeting of the Local Section of the Ontario Branch of the American Society of Mechanical Engineers and the Toronto branch of the Engineering Institute of Canada, held at the Engineers' Club, Toronto, on Wednesday, July 3, an interesting address was given by

Mr. C. Holmes, of the Invalid Soldiers' Commission, on the subject of re-educating the returned soldier. Mr. Holmes stated that every man who, after returning, was so disabled that he was unable to re-enter his former class of employment was being given a course of training by the Commission, in that phase of activity in which he would be best fitted. An exhaustive examination is made of each man in a most thorough manner in order to gather full information, not only as to what class of work the man followed before the war but to determine that phase of work which each man has or had an inclination to follow at some time during the course of his career. Emphasis was placed on the necessity of using a certain amount of strategy in order to bring to light those tendencies or likings which every man has or had for a certain trade or profession.

In order to enumerate those operations which disabled men can successfully accomplish, a survey was first made of the industries. The head of the industry was first approached; then the method was to work down to the individual foreman himself. Each machine is carefully analyzed as to what manner of disability would least inconvenience a man in operating that machine. Up to date 150 industries have been surveyed in this manner, and never one refusal has been met with from the industrial men. Four hundred and twenty returned men have been placed, 90 per cent. of whom are giving the most satisfactory service.

Mr. Holmes spoke of a case where a man with both legs off and one eye out is receiving $85 per month for his services and his employer states that these are entirely satisfactory. Another case was noted where a man totally blind is successfully filling a position of trust on general office work, is receiving a good living wage and is at present in line for promotion. A man who was formerly a structural steel worker, had his foot blown off and is now successfully filling a position on a bench job in a large structural steel firm.

The important fact that the returned man has earned the right to some concession was duly emphasized. Although by nature of his disabilities he may not be able to do the work as fast as the other fellow, yet it is being proved every day that he can do the work just as well, and surely employers can temporarily overlook the small difference in speed as not detrimental but an unavoidable condition which is a matter of trifling consequence in the pursuit of the great Dominion-wide problem of establishing the returned man into civil life.

The rate paid by the government to the men during their six months' course is not less than $50 per month. There is not a married man who is paid less than $73 per month. It must be borne in mind that responsibility has been lifted from the shoulders of these men from the time they have enlisted; they have been clothed and fed, and it is up to not only the industrial heads, but to the man in the back of the shop, to see that every means can be given to enable the returned hero to assume his former responsibilities.

The Dominion Bridge Co. has received an order from the Imperial Tobacco Co., Montreal, for a 400 kw. turbo-alternator.

Largest Vertical Gas Engine

THE largest vertical gas engine yet constructed has recently been completed at Manchester, England. The outward appearance shows a somewhat lofty design, but when the large output of 1,080 brake horse-power developed at a speed of 166½ revolutions per minute is considered, the floor space occupied by the engine is comparatively small. The engine is of the totally enclosed type, being provided with small inspection doors at the front and back of the crank case. Access to the mechanism is provided by two operation platforms. There are three double-acting cylinders of 26 in. bore and 30 in. stroke. Each cylinder is constructed with a separate liner, flanged at the top and bottom, and securely bolted to the upper and lower combustion chamber.

The water cooling arrangement has been carefully considered. Cold water enters at the lowest point at each cylinder cover, which contains the stuffing box, then enters the jacket of the exhaust box and lower combustion chamber, and finally passes into the cylinder jacket. The gas and air to form the mixture are kept separate until they reach the inlet valves and the proportions of the above gases can be regulated from the floor level by means of an electric motor with the hand-speeder gear. An emergency governor is provided and coupled by mechanism in the main gas supply pipe.

The valves are made removable by the provision of cages, which seat into the combustion chambers, each valve with its seating and cage comprising a removable unit.

In leading away the exhaust gases from the cylinders, the top and bottom exhaust boxes of the combustion chambers are separately connected by short expansion pipes, which are constructed with trepanned joints to permit of expansion and contraction. The exhaust box casings are water-jacketed, and two pipes convey the exhaust gases away from the engine, the idea being to utilize the waste heat for raising steam in the boilers.

Plank Bridge Floor Covered by Tar Mat

THE increasing cost of lumber for repairing bridge floors has brought about methods of resurfacing those floors which have become worn and uneven. The great objection to common plank flooring has been its tendency not only to loosen and warp from exposure and cause an undue amount of vibration, especially in a pin connected structure, but to wear into holes, leaving the knots in the wood projecting above the level of the more easily worn wood fibre. Although concrete floors are now being used to a large extent, yet there are still many bridges in the country having plank floors which may be placed in good condition at small cost by the following method, described in a paper presented by Mr. G. F. Barstow at a recent meeting of the Minnesota Surveyors' and Engineers' Society:

The bridge was gone over carefully and all large cracks filled in with lath toe-nailed to the planks. All loose plank were spiked down. A small gasoline fire engine belonging to the city was taken down to the bank of the river and supplied water for washing the plank floor with the fire hose. As soon as the bridge was dry it was given a priming coat of Tarvia B, which, it is stated, penetrated into the planks about ½ in. As soon as the Tarvia B was absorbed by the plank, a coat of Tarvia A heated to 125° F. was applied and immediately covered with gravel which had been run through a 1-in. screen. As soon as the gravel had been spread the bridge was opened to traffic and in about 10 days the second coat was applied in the same manner. Ten days later the third coat was put in.

Nearly all unevenness of the plank was taken out by the tar mat and there was a fairly smooth floor. Examination of the bridge last February showed that there had been no scaling and that the coating was as good as it was last fall. It is intended to give the bridge one more coating this summer, for the purpose of removing the unevenness. In the new coat the tar will be covered with crushed rock chips that have been run through a ½-in. screen and have had all the dust screened out of them.

The entire job cost $516, and it is figured that if one coat is applied every year to keep it up that it will cost less than half as much as replanking every five or six years, and there will always be a good smooth floor on the bridge. The planks are also well protected from the moisture and will last for a good many years before they decay.

Cost of Operating Tractor

THE present increasing use of tractors for farm work has shown that this method not only reduces the number of men required, but also tremendously increases the amount of work that can be accomplished. In the British Isles, searchlights are frequently used on the fields for ploughing at night. Although this is a war expedient, yet the method may survive, especially in seasons when the climatic conditions are such as to require increased speed at certain times of the year in order to complete the work. There should be just as much reason in running a large farm by shifts as running a plant in this way, provided, of course, sufficient labor can be secured.

The chief cause of hesitancy on the part of the Canadian farmer to adopt the tractor is probably the uncertainty with regard to cost of operation. On account of the industry being in its infancy, cost figures are few and none too reliable. However, an interesting report recently appeared in the Reclamation Record giving figures compiled by Mr. G. A. Benjamin, superintendent of irrigation on the Sun River project, which appear to bear the stamp of reliability. The following facts are worth reproducing:

The main trouble encountered was in securing the services of capable and reliable tractor operators. As soon as men could qualify as operators two operators and two ploughmen were put on each tractor, which was operated two shifts daily. The first shift worked from 4 a.m. to 12.30 p.m., with one-half hour for breakfast and the other shift from 12.30 p.m. to 9 p.m. with one-half hour for supper. The land ploughed was classified and prices made accordingly. Alfalfa sod if stony was plowed for $8 per acre, if free from stone for $7 per acre; raw land in buffalo sod was rated at $6 and $6.50 per acre; charges for cultivated land which had not been ploughed for two or three years were $5 and $5.50 per acre; and stubble ground $3.50 to $4.50 per acre. Little stubble ground was ploughed.

By averaging the cost on 23 jobs it was found that the average field cost per acre was about $3.30, the average cost per acre for fuel $1.13, and for lubricants 21 cents. The cost keeper's statement taken from the cost ledger, which included ploughing and harrowing, repairs, miscellaneous expense, superintendence, general expense, and equipment charges, shows the total cost of ploughing [illegible] acres to be $3,369.24 or $5.75 per acre. As the returns when collected will average about $6 per acre it is evident that the charges per acre are just about sufficient to reimburse the Government for the cost of the work.

Building Brick Controlled in England

IN order to conserve the supply of building brick in England the following order has been issued by the Ministry of Munitions:

1. No person shall as from the date hereof until further notice sell or, except for the purposes of carrying out a contract in writing existing prior to such date for the sale of building bricks, deliver any building bricks of any description except under and in accordance with the terms of a permit issued under the authority of the Minister of Munitions, or purchase or, except for the purposes of carrying out such a contract as aforesaid, take delivery of any such building bricks from any person other than the holder of such a permit and in accordance with the terms thereof.

2. Notwithstanding clause 1 hereof, no such permit shall be required for the sale, purchase or delivery of any building bricks to be used exclusively by the purchaser in the erection or carrying out of any separate and independent building or work not involving in such erection or carrying out the use of more than 20,000 bricks, or in the completion of any building or work lawfully commenced prior to the date hereof where such completion does not involve the use of more than 20,000 bricks as aforesaid, provided always that in each of such cases the purchaser shall have given to the seller at or before the time of purchase and delivery a declaration in writing signed by the purchaser specifying the precise nature of the work for which such bricks are required and the place where the same are to be used, and that the bricks to be purchased are for the purposes mentioned in this clause and for no other purpose.

Every declaration made for the above purpose shall be true and accurate in all respects.

3. Every manufacturer of building bricks shall comply with all such directions regarding the transfer or delivery of the bricks from time to time manufactured by him as shall from time to time be given to him on behalf of the Minister of Munitions by the Controller of Building Bricks, Ministry of Munitions.

4. Every person manufacturing or having in his possession any stock of building bricks shall furnish to the said Controller such returns as the said Controller may from time to time direct concerning output, stocks, deliveries, cost of production, prices, or any other information relating to such building bricks.

5. All applications for permits under this order shall be made to the Controller of Building Bricks, Ministry of Munitions, Whitehall Place, London, S.W. 1, and marked "Building Bricks Permit," and every person selling, purchasing, delivering or taking delivery under any such permit shall observe and perform all the conditions subject to which such permit shall be granted.

Cost Systems and Efficiency in Contracting

By G. Graham Reid

IN a recent issue of the "Contract Record and Engineering Review" there appeared an article urging the use of cost systems and illustrating the benefits proceeding from them. Directly below appeared a criticism of the lump sum contract method of doing business and advocating the cost plus method as a more efficient and less haphazard way of getting results, protecting the contractor and purchaser alike.

These two things, it seems to the writer, are largely to be explained one by the other. It has been his experience on lump sum contracts, large and small, where he has been employed in various capacities, that where costs were used at all, they were made in such a way as to be of little use either at the time or afterwards. In two cases on contracts involving over $200,000, attempts were made on intricate forms to keep progress reports and determine the cost of each part of the work as it proceeded, and several clerks were employed to do this. At the end they could tell to a fraction how much a particular unit of the work had cost and how much had been spent daily, weekly and monthly on it, but when asked how much the brick work had cost per thousand, or how much it had cost per foot to lay a certain section of pipe, they were almost altogether at sea, and would have to resort to a more or less inaccurate reckoning to get the result.

In another case, so many changes were made in the system at different times, that the whole thing was almost altogether useless, and piles upon piles of sheets with data gathered at great cost, had to be thrown away for lack of a proper method of expressing results. Had this matter received the attention in contracting work that it has in other industries, such a state of affairs would certainly not exist, but very few men and only the more up-to-date ones, seem to have studied the matter carefully. The result is a set of bids such as are set out—$96,400, $112,447, $114,300, $124,253, $125,574, on the same work. And this is only an example of what occurs all too frequently, especially on smaller contracts. The writer has in mind an incident which happened in connection with the letting of a contract for a concrete arch bridge, in Western Ontario, this spring, where he was one of the bidders. Bids of $1,530, $2,480, $2,880, and $3,200 were received on the same job and the contract let to the lowest bidder, who happened to be a well-known and experienced contractor in that vicinity. Here there is a difference of over 100 per cent. between the lowest and the highest bidder, and had this man had any proper system of estimating, based on data taken from his long and varied experience, he should have saved himself considerable money and the other contractors a lot of useless work. These two examples serve to illustrate the same state of affairs existing among contractors, both large and small.

Then again, how many contractors know each day and each week as their work progresses how much money they are making, or if they are making any at all? Not only should an efficient system of costs be a basis of estimating on further work, but it should tell to the contractor each day and week and month, how much money is being spent and how the amount compares with the estimate. In this connection, the writer might cite an incident which occurred in the carrying out of a contract in the city of Toronto, on which he was employed in a minor capacity. Two clerks were employed to keep costs and were instructed by the managing director exactly as to how these were to be tabulated. These men came under the supervision of the general superintendent, who was unable in any way to criticize or direct their work, except to see that they were busy and kept proper hours. Neither the superintendent nor any of his men had any idea as to how much the job or any part of it was estimated to cost. The managing director seemed to think that it was necessary to keep his men altogether in the dark, even to the amount of the contract. The result was that when they began to lose money the superintendent knew nothing of where they were exceeding the estimate, and nevertheless received all the blame. The work was eventually taken out of the company's hands and they and their superintendent parted, both sides feeling that they had not received a fair deal.

Nothing is to be gained by secrecy in these things, and if contractors would realize how they are spiting one another in not mutually benefiting by their experience, matter would be helped a great deal. In no business has competition been so keen and bitter as in contracting, and the time has come when we should realize the value of co-operation in handling labor and in receiving and successfully carrying on our business.

Item	Brick Work	Concrete			Excavation			Etc.
		Cement	Gravel	Steel	Coffer-dam	Dry ex.	Wet ex.	
Brick	$650.00							
Bricklayers	$60.00							
Cement		$680.00						
Gravel			$160.00					
Laborers	$25.00		$20.00	$30.00	$150.00		$120.00	Etc.
Carpenters								
etc.								
etc.								
Totals	$735.00	$680.00	$180.00	$30.00	$150.00		$120.00	$1895 Total for day

Date—June 25, 1918.

The following form may be found of interest to smaller contractors and by proper enlargement and development can be used and has been used successfully on large contracts:

The estimate for the work should be made to correspond with the different columns in the cost book and by entering data as to the amount of work done each day and week, and dividing out. The unit cost of the different parts of the work may be entered daily or weekly as desired, under their respective columns and compared with the estimate. Again, every employee who is in charge of any section of work should make it his particular duty to know what his section is costing and how it compares with the estimate. This will encourage co-operation and confidence between the employer and his men, and will make them take a firmer grasp of the work and more interest in it. If desirable, a bonus system may be employed, although it is wise not to carry this idea too far, as the average well paid employee should do his best when he knows what he is doing, and a further reward might tend to make him devote too much attention to making money for himself and cause his interest to become too selfish. Should the clerical work be at all onerous in this, some person other than the foreman or superintendent should compile his data for him, as a man's attention cannot be centered on his work and at the same time be performing clerical duties which a lower salaried man could just as well attend to. But at all times, the superintendent should know what his work is costing and whether he is making or losing money, and how much.

Now, it may be argued that he will become too wise, but on consideration of this point, it will be seen that his value has merely increased to his employer, and he can co-operate with him in his figures and estimates as well as suggesting methods of carrying out the work. Any man with any fair amount of education can take hold of, and appreciate this work, although the more education he has the more valuable in most cases he will be. For this reason, it is well for the contractor who wishes to be up-to-date and increase the profits of his business, to consider education as a valuable asset in choosing his men.

If methods involving these things of estimating, bidding, and of receiving and carrying out work were employed by contractors, the writer ventures to say that such bids as are illustrated above would never occur. The contractor would know within a small percentage what the work could be done for and would bid accordingly. Those who undermined this by deliberately slighting their work would soon be out of business and the up-to-date and honest men could take the field and give efficient service for proper consideration.

In works involving great risks such as uncertain foundation, a factor of safety would have to be allowed and on this factor would depend whether a cost plus contract would be advisable or not. The lump sum system should be considered not an absolute form of doing business, but a fair and reasonable method of getting work done which does not involve great risks of any kind, and with the modern engineering experience, this category will involve most of the work being done. Undoubtedly the cost plus system has its merits in many cases where preparation of complete plans and specifications would spell undue delay, and the sooner the public can be made to realize that modern contractors are endeavoring to make their business a fair one of giving value for value received, the better the country will be for it. But only by opening their eyes to the need of co-operation, scientific and careful work, and up-to-date business methods can this result be achieved.

Steel Roller Dam Gives Satisfactory Service

A TYPE of dam comparatively novel in design was constructed by the Reclamation Service in 1917 across the Grand River in Western Idaho, and has successfully filled the somewhat difficult service for which it was designed. The dam was built as part of an irrigation project, and the close proximity of a railway line of low elevation complicated the situation, making it necessary to provide a structure which would hold the water during dry weather at a sufficiently high level for its entrance into the irrigation canal and at the same time allow for some means of lowering the level in flood time, in order to prevent damage to the adjacent railway line. The novel feature about this dam is the cylindrical stop-log used, as indicated in the section herewith. As this figure shows, the stop-log or gate consists of a steel cylinder to which is riveted a curved extension shield braced to the cylinder with struts. Details of construction and operation are given in a recent issue of the Engineering News-Record:

The structure consists of a concrete weir of 480 ft. net length, with crest 8 ft. above the river bed, carrying seven structural steel rollers. Six of the rollers are 70 ft. long and 10 ft. 3 in. high and the seventh roller, which spans the sluiceway opening, is 60 ft. long and 15 ft. 4 in. in height. The roller crests extend between piers upon which is placed the electrical operating mechanism for raising and lowering the rollers. The piers are connected by a steel service bridge.

The rolling crests consist of structural steel cylinders 7 ft. in diameter, to which are riveted curved extension shields braced in the cylinders with struts. The cylinders are provided with a cast-steel rim at each end and the roller moves up and down on a smooth track set in a recess in the pier at an angle of 20 degs. with the vertical. Cogs are provided on the rim which engage in racks set in the piers, preventing any sliding motion of the roller and causing both ends to move at the same speed. Parallel to the track and on the opposite side of the pier recess is a steel guard set in the concrete causing the meshing of the rim and rack teeth.

The operating mechanism for each 70 ft. roller consists of a hoist actuated by a 16 h.p., 220-volt, d.c. electric motor, and for the 60 ft. roller a similar motor of 20 h.p. Through a series of gears the motor rotates the main 5½ inch chain shaft, to which is forged an 8-tooth sprocket winding up a powerful chain which is attached to the rim at one end of the roller. The rollers are driven at one end only, the hoists for two adjacent rollers being placed on the same pier, and hoist houses are therefore provided only on alternate piers.

The 70 ft. rollers weigh approximately 40 tons each and the 60 ft. roller 53 tons. The maximum chain pull required to raise the rollers is 28 tons for the 70-ft. and 48 tons for the 60-ft. roller. The chains are of special design and are made up of heavy pins and links manufactured from high test steel with an ultimate tensile strength exceeding 80,000 lbs. per square inch.

The time required to raise one of the 70-ft. rollers from the lowest to the highest position, a distance of 16 ft., is 15 minutes. For starting about 35 amp. of current is required and an average of 25 amp. is used during the period of raising. This is equivalent to a power consumption of about 1.5 kilowatt hour.

Electric power for operating the rollers is generated in a power plant at the west end of the dam. This plant contains a generating set consisting of a 4-cylinder automobile type gasoline engine, direct connected to a 25 kw., 250-volt generator. The generator is used to charge a storage battery which has a capacity of 108 ampere hours, but can also be used to furnish power direct to the motors independent of the battery. The capacity of the storage battery is sufficient to furnish power for the raising of three or four rollers without discharging it excessively, and power from this source is used for the ordinary routine operation of the rollers, as required to regulate the height of the water above the dam. However, when all the rollers must be raised, as during the high-water period or during the winter season, power is furnished direct from the gasoline engine and generator. The nine canal headgates at the west end of the dam are operated by a 3-h.p. electric motor.

The power plant and operating machinery have proved very satisfactory, and no difficulty has been experienced in the operation of the rollers. The amount of labor required is reduced to a minimum, and one man easily handles all work in connection with the operation of the dam.

The rollers are, as a general rule, raised to the full height only twice each season, once during the high-water period in the summer and again in the winter to permit the passage of ice. During the remainder of the year the rollers are used to regulate the river and keep the water at the desired elevation. The sluiceway is raised about once a week during the irrigation season, to sluice out the silt and drift from in front of the canal headgate. The floor of the sluiceway channel is 8 ft. lower than the bottom of the headgate openings, forming a settling basin in which the coarser silt in the water is deposited.

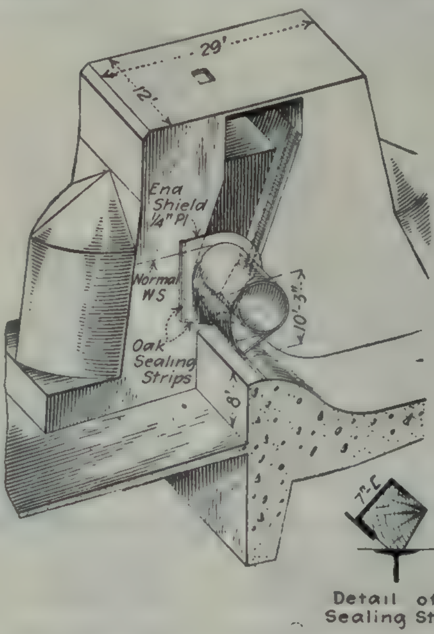
In selecting a type of movable dam, the question of leakage is frequently an important consideration. This was true in the case of the Grand River dam, where it will be necessary at times to divert the entire flow of the Grand River into the project canal. The available information indicated that the leakage through a properly constructed roller crest dam would be very small, and this factor had much weight in influencing the decision in favor of this type, in preference to a wicket or needle dam through which there would be considerable leakage.

In respect to the leakage, it can be stated that the dam has come up to expectations, and that the actual leakage through the rollers is so small as to be practically negligible. The method of securing a watertight seal is shown in the accompanying drawing. The seal between the bottom of the rollers and the concrete weir is obtained by an oak sealing strip which is attached to the lower edge of the extension shield. When the roller is in its down position the weight forces this strip into close contact with the steel sill embedded in the crest of the weir. The seal at the ends, which is somewhat more difficult to make watertight, is obtained by use of flexible steel shields, the upstream edges of which are lined with wood. These shields are thin and flexible, and the water pressure keeps them tight against the sides of the piers. The piers are slightly battered at the bottom, giving a wedging effect as the roller is seated and also allowing clearance after the roller has been raised a few feet.

There has been no occasion up to the present time to divert the entire flow of the river into the canal and, other than the construction of the shields and sealing strips as above described, no particular attention has been given to the matter of making the rollers watertight.

No leakage whatever occurs through the rollers except at the ends, and the total leakage through this roller is estimated at not to exceed one-half cubic foot per second. This leakage could no doubt be further reduced by securing strips of rubber belting or of similar material to the timber strips.

Practically all the leakage seems to take place through the horizontal seal at the bottom of the end shield. The inner edge of this shield is of necessity rigidly attached to the main cylinder, preventing sufficient play to wedge the inner edge of the seal tightly against the pier. It is probably not feasible to eliminate leakage entirely at this point, but it is believed that this leakage can readily be kept below one-half second-foot per roller.



In general, it can be stated that no difficulties worth noting have been experienced in the operation of the Grand River Dam and that it is admirably adapted to serve the purpose for which it was installed. The principal merits of the roller crest type of dam are simplicity and speed in operation, with economy in the use of power and the small amount of leakage through the rollers.

The Montreal Builders' Exchange has received some enthusiastic endorsations of the proposal to hold a conference of various contracting interests to discuss labor and materials, foreign competition, tenders, and problems relating to present and after the war conditions. A circular was sent to the builders' exchanges throughout the Dominion, and in reply the Toronto Exchange has decided to appoint delegates to the conference. The Halifax Constructive Mechanical Trades Exchange endorse the proposal, while the Provincial Builders' and Supply Association of Ontario, at a meeting in Galt, recommended the various Ontario Exchanges to send representatives to the conference. The St. Catharines Builders' Exchange expressed approval of the conference. The meeting will not be confined to Builders' Exchange members, but will be open to firms representing contracting interests generally, such as shipyards, railway, dock and dam contractors.

Can Small House Construction be Cheapened?

At the present time when the need for small houses and the high price of material are tending to cause far from favorable living conditions in many of our cities, it would seem to be opportune to raise the question as to whether there is not a considerable amount of excess material in our small houses. Perhaps walls are thicker than necessary, floors will carry much greater loads than they are ordinarily subjected to, etc. When a contractor builds a small house he does not concern himself with figuring floor loads, etc., but ordinarily uses such material as is customary in this style of building. Again, there is little doubt that up to the present, the extra time necessary in calculating the required size of timber, etc., would not result in enough material being saved to give any appreciable decrease in cost. But probably the time has come when we must carefully work out the details in the design of the small houses, in order to cut down expense by the elimination of any extra material.

That this matter is receiving attention in the British Isles is shown by a paper presented at the annual Scottish meeting of the Institution of Municipal and County Engineers, by Mr. W. A. Macartney, Assoc. M. Inst. C. E.

A matter which the Minority Report of the Scottish Royal Commission on Housing makes much of is that a considerable number of municipal schemes have, from their inception, been a burden on the rates. This, however, does not warrant the suggestion that private enterprise can build better and cheaper than the community. The housing report does not mention the number of speculative builders who have gone into liquidation during the last twenty years, but the number is very considerable. Nor does the minority argument hold good that because asylums, schools, etc. are substantially constructed, so municipal housing will also be carried on in a like elaborate scale, and continue to be dependent on rates.

If we look into this matter we shall find that schemes are non-supporting from a variety of causes which, however, need only be briefly mentioned in their order of importance, viz.:

(a) Work which private enterprise would not touch—the rooting out of slum areas and the provision of houses for the poorest, with possibly the utilization of sites which were costly to purchase or build on, but were the most suitable for the people to be housed.

(b) The provision of a sinking fund by which the capital cost is paid off in thirty to sixty years. With private enterprise no provision is made for such a repayment, hence the great difficulty in getting rid of old property, the owners thinking that their properties are still worth the same amount as when they were built because possibly the rents are unchanged.

(c) The disinclination of some local authorities to charge an economic rent even when the above causes do not operate.

(d) The conservativeness of some local authorities and their officials in adhering to certain more or less standardized designs and forms of construction. The two first mentioned reasons will remain and operate in municipal housing schemes, to some extent at least, but there is no reason in the world why the last two should not be altered. It may further be pointed out that in the more recent schemes quite a good proportion are self-supporting, while in others the loss is trifling.

It is the author's opinion that further economies can still be effected in the design and construction of houses. Meantime he submits that the facts as given do not warrant the suggestion of the report that local authorities are unable to carry through a housing policy. One has only to look at the success they have made of such one-time provinces of private enterprise as trams, water, and gas to remove all fears on this point. In the relatively unimportant schemes of municipal housing which have so far been carried out there have been mistakes, but even these have leaned to virtue's side, and can be avoided in the future. All progress is made by knowing and avoiding the mistakes of the past, and local authorities are entitled to a proper chance to show what they can do, such as they have not yet had, before they are judged or condemned. Their responsible officials are generally, one may say without boasting, as capable of dealing with the subject as speculative builders or achitects, and they have been for years gathering information and preparing for the present contingency.

It is a matter of congratulation that the terrible shortage of houses is not in dispute, as it allows one to proceed to deal with one way in which the need may be met—viz., by greater economy in both design and construction. It is not claimed that this will solve the question, but it will assist in its solution. Some progress has already been made with this matter during the war, and it is more than likely that proposals of genuine merit will be favorably looked on by the Local Government Board or whatever central body may be charged with the oversight of the new housing work, even though standard practice, building by-laws, and some of the provisions of the Police Acts are not rigidly adhered to. Using a military metaphor, the idea of the author in this part of the paper is to point out some of the positions taken up by the advance guards in the matter of building construction, and to endeavor to bring the main body, which is always slow of movement, into the same positions as far as these are reasonably safe. The said main body has been long enough in the trenches; let it now get into the open, depending less on what has been done in the past and more upon its own intelligence in the new operations it may soon be face to face with.

Walls—Thicknesses.

The by-laws of the institution standardising general practice suggest the following thicknesses for walls: One storey, stone, 16 in., brick, 9 in.; two storeys, stone, 18 in., brick, 14 in. (1st), 9 in. (2nd); three storeys, stone, 20 in., brick, 18 in. (1st), 14 in. (2nd), 14 in. (3rd).

The practice of the last few years and the class of house now being built will allow some reduction in these thicknesses, particularly in the brick wall. When it is pointed out that the storeys referred to may be 14 ft. high, it will be seen that in houses with 8-ft. or 9-ft. ceilings a thinner wall ought to be and as a matter of fact is, perfectly safe. If the roofs were carried on trusses at intervals, then brick butts could be formed to bear the roof-load and the intermediate walls filled in with 4½-in. brick strapped and lathed, but if the usual type of roof be used then a 9-in. brick wall is perfectly safe for two storeys, and a 12-in. cavity wall is even stronger and in some respects better.

Cheapest Type of Wall.

As the result of a number of inquiries made to representative Scottish surveyors, it seems that the 10-in. hollow concrete wall plastered on the hard is the cheapest form of wall. The 12-in. hollow brick wall roughcasted outside and plastered on the hard inside seems to cost about the same as a 9-in. wall roughcasted and waterproofed outside and plastered on the hard inside.

So far we have not had brought to our notice the use in Scotland of brick roughcast and waterproofing for external walls of dwelling houses with no internal strapping, though the system has been used in the more salubrious climate south of the border; it is more than possible that unless most carefully done such a system would not be found to stand our climate.

Timber.

Up to the end of the last century there can be no doubt that architects and builders erred on the safe side in their use of timber, and, with prices as they were, rightly so. One cannot deal with timber as with steel and say just what it will stand before rupture, and consequently the factor of safety is high. It is a question now if this factor of safety cannot be lowered. If instead of a factor of 7 we had a factor of 5, we are effecting a considerable saving of material and thus also reducing the cost. It is to be regretted that we have no very definite figures to go on in respect to the strength, deflection or breaking load of timber, and it may be suggested that the Local Government Board should be empowered to make arrangements for a series of tests on floors of temporary huts before they are taken down, so that more reliable data may be obtained for our guidance in this most important matter.

Floors.

From inquiries made it would seem that the standard weight assumed for dwelling house floors varies from 70 lb. per sq. ft. in Aberdeen to 1½ cwt. in Dundee. In Glasgow the figure is 1 cwt. per sq. ft. with a factor of safety of 7, and possibly this is pretty generally used. It could easily be shown that this figure, while apparently high, is not very far beyond the safe margin for city tenements except perhaps in regard to the factor of safety. Where the by-laws fail is in their rigidity; they require to be used with discrimination. In tenement houses one might insist on a certain safe standard, but in the semi-detached houses where the bedrooms are small the amount of timber in the floors might safely be reduced.

In tables compiled by the author an attempt has been made to arrive at a solution of this vexed question along the lines of discrimination he has just referred to. The maximum weight assumed for all floors is 100 lb. per sq. ft., but rooms to be used as bedrooms or boxrooms are assumed to be quite safe if they stand a maximum load of 70 lb. per sq. ft. The factor of safety is about 5 for Baltic fir, though, owing to the variations in timber, this figure may be up or down. These figures (100 lb. and 70 lb.) have not been chosen at random, and while lower than what has hitherto been accepted are perfectly safe for the conditions mentioned.

Flooring.

Modern conditions producing cheap floorcloth will allow a reduction in the thickness of flooring which at ⅞ in. is still safe enough; floorcloth, carpets, or rugs are now used in all but the very poorest class of houses, and the wear is not on the wood but on the floor covering. In certain cases an economical ground floor can be obtained by covering the site with 4 in. to 6 in. of breeze or clinker concrete with, on the top of that, a damp course of asphalt or bitumen, and thereafter laying down timber joists 2½ in. by 2 in. or so, to carry the ⅞-in. flooring.

Roofs.

The same general remarks apply to roofs as to floors. One certainly finds roofs which have sagged more or less, but an ordinary cottage or tenement roof which has collapsed altogether is a very uncommon thing.

The writer is of opinion that for ordinary houses one may reduce the amount of timber in the roofs without much risk. This may be done with perfect safety in either of two ways—viz.: (1) To retain the present usual sizes of timber and increase the interval between roof couples to 22 in. or 24 in., or (2) to retain the present interval of 18 in. and reduce the sizes, for example, 6½ in. by 2½ in. joists would be replaced by 6 in. by 2 in., and so on.

As a further economy in roof construction, the elimination or at least a curtailment in the use of roof dormers is to be advocated. Actual figures show that the cost between a storey and half and a two-storey house is negligible, and the full storey, besides reducing the amount of timber, consequently means a cheaper house per cub. ft. and also a more pleasant one to live in.

Drainage.

Without entering into the differences of opinion in regard to drainage by-laws, the author would point out that with careful attention to house planning, considerable expense could be avoided. This has reference chiefly to the positions of bathrooms, water-closets and sinks, and if these are grouped, only a minimum of traps, ventilation-shafts and lengths of drain are necessary. Where houses are built on the open system it seems perfectly right to make one connection and one disconnecting trap serve a group of six or eight houses. Were the houses to be owned separately such a system would possibly lead to trouble, or the local authority taking over and maintaining the drains. Where, however, the houses are to be owned by the local authority themselves, trouble need not be anticipated.

Lay-Out.

Generally speaking the design and details of the lay-out should depend on the site. Wherever possible the lines of streets should follow the contours, as this will save expense in street and sewer construction, and also in house construction where one is building long blocks. The width of carriage-way in streets should not, except in the case of through roads, be wide, and examples of suitable widths and constructive details can be found in several town-planning schemes either finally approved or ready for official approval.

In the open type of development the most expensive design next to the cottage (which is not here recommended) is the double or semi-detached house. Obviously it is not possible to put a figure on the exact difference in cost between a pair of semi-detached houses and, say, eight in a row; but it may be safely put down at not less than 5 per cent per house. This sum, however, is exceeded when one adds (as one must properly do) the extra cost of street construction, fencing, main sewer, water and gas pipes. The author has taken one recent scheme for 100 semi-detached houses, and he finds that with the same area and length of streets, 120 houses in blocks of eight could be obtained.

Even where the total number of houses per acre is limited to a definite low figure, one can still build in blocks and throw the additional land, not into street frontage, but into back greens, allotments and open spaces. There is this point to be considered, however, that in hilly or undulating land the advantage may lie with the semi-detached house, because the larger block will possibly require considerable underbuilding to bring all its floors to one level, or if its floors are dropped the expense of a break or breaks in the roof has to be faced, and this will about balance any saving otherwise effected.

Conclusion.

The author submits the foregoing facts, figures and suggestions, not with a view to encouraging slim and shoddy work, but simply to prevent waste and to simplify and facilitate the erection of houses which will serve their day and generation. Materials and fittings are to be recommended simply because they are cheap, but no one should bang the door on any new system of construction or suggested alteration of building practice without giving it fair consideration. An open mind is a great advantage in these times.

A Concrete Motor Boat

ALTHOUGH concrete is now being used extensively for large boats, the possibility of using it for motor boats has been somewhat dimmed owing to the excessive weight of the hull and the lack of flexibility necessary in small craft for the general use of the contractor. These objections are, probably, not as serious as first anticipated, and appear to have been successfully overcome by a type of construction explained in the following article appearing in the "Engineer". The actual boat in question has a displacement of 28 tons on 4ft. draught, and she weighs only 8½ tons; she is, in fact so lively, that we could rock her easily by standing amidships and swaying from side to side. With regard to the question of resiliency, we cannot, of course, speak from any experience or any tests we have been able to make—the sea-going test is, of course, the only thing that will set the point definitely at rest, but the details of construction do appear to us to afford every hope of satisfactory results.

The keel, which is bent round up to the stem head and over the bow chock, consists of a flat mild steel bar 2in. by ¼in., which is connected to a 1⅛in. diameter keelson, which runs right fore and aft by a number of flat bars or clips, 1in. by ⅛in., which are riveted into the keel and clipped over the keelson.

There are two ½ in. diameter mild steel bilge stringers, and then three more stringers, one acting as a gunwale and two at intervals just below, and two deck stringers on each side, which carry the deck as far as the hatchway openings. The frames consist of ½in. diameter mild steel rods carried continuously right around the hull from coaming to coaming, and clipped to the keelson and joggled to receive the stringers. The frames are then faired up just as the mould timbers of a wooden boat would be, and on these surfaces is laid a covering of expanded metal in plates 8ft. by 2ft., wired to all the frames and the stringers. When this inner skin, so to say, is complete, the garboard strake of an outer expanded metal skin is laid on and wired up, being separated from the inner skin by a series of ¾in. concrete distance pieces.

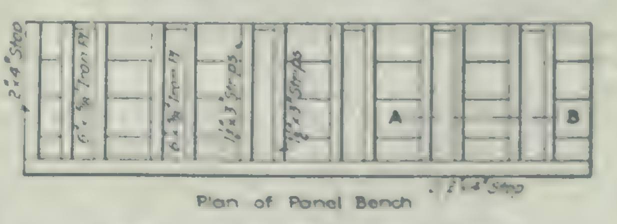
Concrete of 5-2 mixture sand, washed through a ¼in. sieve, is then rammed in between the two layers of expanded metal, the concrete which exudes from the metal being added to and wiped smooth on each side, so that a skin 1½in. thick is produced. The next strake of metal is then wired on and the ramming proceeds until the whole is finished, the job being continued night and day until completion.

The fact that the concrete is only rammed in 2ft. depths should result in a really well compacted monolithic mass, and the design should give strength, although it is, of course, difficult to carry mental vision from a 40ft. by 8ft. 6in. by 4ft. 9in. launch to a 400ft. ship on the same general design. One thing that we did note is that the bulkheads which are solid for the whole beam and depth of the boat, sound resilient, and give out quite a reverberation, and not at all a dead sound.

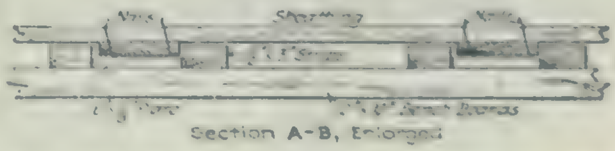
The engine is a four-cylinder high-speed car type motor, so that we had no opportunity of judging the effect on the hull of one of the single-cylinder slow-speed, heavy type engines, which would more ordinarily be used in such a boat. This engine, which is of 25 horse-power, is stated to be capable of giving the boat a speed of 8½ knots when light.

Nails in Concrete Forms Clinched by Using Metal Strips

IN order to prevent the spreading of forms due to nails pulling out, Mr. Chas. A. Roos describes a method in the "News-Record," which has been used by him with success. Small iron plates laid on top of the framing table under the battens were used in making up form panels to clinch the nails. The top of such a framing table, with the plates in place and a panel in position for nailing, is shown in the sketch. To make the nails clinch more easily they are driven at a slant.



Plan of Panel Bench



Section A-B, Enlarged

How to Take a Heavy Traffic Census

A MOST important detail, in considering the type of a road, is that of a traffic census. The different classes of vehicles must also be carefully noted, as there is every possibility of a heavy truck doing more damage to a road in one trip than other vehicles would in a great number of journeys. Data gathered from various sources have led to the belief that there should be a regulation regarding the width of iron tires, as vehicles with heavy loads and narrow tires rapidly tear or line a road surface; automobiles having chains on the tires are very hard on an asphalt pavement, especially if the pavement is new. Not only is a census used in the preliminary investigation of road problems, but it also is becoming a standard method of studying transportation problems at certain centres of traffic. Such a census was taken in 1916-17 in Chicago with a view to supplying information for a street widening project on Michigan Avenue, the methods and results from which were described by Mr. George D. Lenth, assistant chief engineer of sewers, of the Board of Local Improvements, Chicago, in a paper recently presented before the Western Society of Engineers:

It was decided to count all traffic vehicles which came into the central business district, which is bounded on the south by 12th St., on the west and north by the Chicago River and on the east by Lake Michigan. Counts were made at the 19 avenues of approach to this district. Traffic for the purpose of the census was divided into two classes: Automobiles carrying passengers, and self-propelled or horse-drawn vehicles used to carry freight, etc.

It was decided in the count that a record should be made of each and every vehicle entering this district, and that each vehicle entering the district must be accounted for, either by leaving the district during the hours of observation or be located somewhere within the district.

Count all Automobiles Entering or Leaving.

The first count was made during the period June 21, 22, 23, 24, 26 and 27, 1916. This count started at 7 a.m. and operated continuously without interruption until 7 p.m. All automobiles, except those used for coming into or going out of the central business district, at all points of ingress and egress, were counted, and a record by license number and time of observation was kept of every car that came in and went out of this district for the period of six days. In addition, during this same period, the central business district was divided into blocks or groups of blocks, according to their locality. Observers were stationed so that at intervals of an hour all automobiles standing in these blocks were counted, the numbers of the automobiles noted, and other data recorded.

The purpose of this count was to ascertain the volume of traffic over all of the bridges and entrances into the central business district, its distribution over the central business district, and the daily fluctuation of traffic.

The average number of vehicles and automobiles counted each day during this count was 49,590, of which 15,634 passed the north side entrances, 13,615 the west side entrances, and 20,341 passed the south side entrances. Concurrently, there were counted during the five days vehicles standing in the various blocks of the central business district, and there was a record of over 800,000 observations.

The second count was during the period June 29, 30, and 31, 1916. This count was started at 8 a.m. and was kept continuously without interruption until 11.30 p. m. In this count there was noted every automobile crossing Rust St. bridge and the arrival and departure of automobiles from 105 of the principal buildings, hotels, theatres, restaurants, and other active office buildings within the central business district. The number of the vehicle as indicated by a license number was recorded, together with the number of passengers and time of observation.

Making Special Counts.

The purpose of this count was to show the relative use of Rush St. bridge and its importance to the owners and tenants in the buildings in the central business district.

On June 30 there was recorded going north at Rush St. bridge in the period of 15 hours 7,723 automobiles, or an average of 515 per hour. The maximum number observed was 959, between the hours of 5 and 6 p.m Going south on the same day there were 7,278 automobiles, or an average of 485 per hour, with a maximum of 680 between the hours of 4 and 5 p.m.

Census of Commercial Vehicles.

The third count was distinctly a commercial count and was made during the period of July 17, 18, 19, 1916, and started at 8 a.m. and continued until 5.30 p.m. This count was 2½ hours shorter than the previous counts, because all of the freight houses and business houses closed at 5.30 p.m., and because of the rule that no teams were allowed to enter the railroad terminus just east of Michigan Ave. after 5 p.m.

A study of this traffic count shows that there were from 40 to 50 stops or interruptions in traffic every hour, and that on an average 25 per cent of the time spent going from Randolph St. to Chicago Ave. was spent standing in Michigan Ave. This is due to traffic regulation. The traffic was tied up for two or three blocks whenever the cross traffic was given the right of way of one-half a minute. The figures of the count show that the solution of the traffic problem necessitates the separation of the automobile and commercial traffic by placing each on its own plane.

Record was made of 28,274 east and west-bound vehicles interrupting the north and south-bound traffic. On July 19 1,200 commercial vehicles crossed Michigan Ave. and South Water St. going west, interrupting the progress of 540 north-bound automobiles and 261 south-bound automobiles during a period of 9½ hours.

On the same day there was interrupted by the north and south automobile traffic 2,079 east and west-bound commercial vehicles, averaging over 57 interruptions per hour, with a maximum of 67 interruptions between 1 p.m. and 2 p.m., in which hour 206 east and west-bound commercial vehicles were delayed.

Comparison of Week Day and Sunday Traffic.

The fourth count was a 12-hour count from 8 a.m. to 8 p.m. on Sunday, July 16, 1916. In this count all automobile traffic not commercial passing on Rush St. bridge and all entrances into the central business district, were counted. In fact, on this day the same methods were used in enumerating as to the automobile traffic in the central business district as were used on the first count. The purpose of the count was to compare the week day traffic with the Sunday traffic.

Record was made of 34,400 automobiles entering the central business district on Sunday as compared with 49,590 on week days. On July 16 there were 7,477 automobiles going north during the 12-hour period for the intersection of 12th St. and Michigan Ave. The maximum was between 7 p.m. and 8 p.m., when there were 1,108 counted. In addition there were 6,575 automobiles going south with a maximum of 906 between 7 and 8 p.m. Compare the above with the amount of traffic which crossed Rush St. bridge, which is at the other end of Michigan Ave., where 6,950 automobiles went north with a maximum of 800 between 4 and 5 p.m., and 5,835 automobiles going south with a maximum of 840 between 7 and 8 p.m.

One of the conclusions to be drawn from these traffic counts is that the automobile has become a means of transportation used by thousands of persons who can afford a rapid and exclusive service. The traffic counts taken show conclusively that 85 per cent of the daily use of the automobiles using Rush St. bridge and Michigan Ave. as well as all other entrances into the central business district, is for business purposes.

Organization and Method of Taking Count.

The count was made by 250 juniors and seniors from the University of Chicago, who were paid $5 per 12-hour day. It was necessary to carefully train and drill the men with captains, and assign relief squads so that the work of the count could go on without interruption. The count was recorded on field note books.

In counting the traffic on Michigan Ave. an automobile was placed in the roadway facing south and another automobile was placed facing north. These machines were placed in the centre of each of the roadways, and as a result all automobiles passing at this point had to go to one side or the other of the stationary cars. In each of the cars there were four observers. One man called the number of the car as it passed, the second man recorded it, the third man called the time and the fourth man acted as relief. At other points the number of observers varied from 2 to 8. Frequently there were four men, each man taking traffic in one direction only. The observers noted the car number, calling to the recorder the state license number or name of state license tag. In addition, the observer at five-minute intervals, depending entirely on the volume of traffic, would call the time so that between the time calls there would be a series of numbers showing the numbers of automobiles passing in the interval. Concurrently, all machines standing within the central business district were counted. Each block in the central business district was given a number, and the counter made a trip over each block every hour. These counters recorded time intervals, and the automobiles within the block during that interval by license numbers.

Reported Each Day.

Upon the completion of the day's work each counter and observer reported to the office, and there made an affidavit before a notary as to the correctness of his work. These books were then turned over to the clerical staff of some 62 men. The information was recorded on ledger cards 5x8 in. in size. A ledger card was made out for each and every automobile having an Illinois license number, and from the field note-books there was recorded the number and the point of observation, the direction of travel, or if the machine were standing, its position and the hour. The name of the owner of the automobile and his address were secured from the list of automobile licenses issued by the Secretary of State of Illinois, which volume is issued monthly. The following statistics regarding the magnitude of the first count may be of interest. There were 43,761 different Illinois automobiles counted during the period of the first count. The movements of the 43,761 automobiles were recorded on 74,400 ledger cards, which contained 436,050 items, of which 299,610 are incoming and outgoing movements and 136,440 are records of machines found standing within the central business district.

A study of the ledger card, showing the date, time and place of observation, or its movement, readily classified the car as one used for business or pleasure. The study further proved that the automobile is not solely a pleasure vehicle, but that on the contrary it is distinctly a business vehicle. The following table shows an analysis of the gross figures for the first count, June 21, 22, 23, 24, 25, 27, 1916, from 7 a.m. to 7 p.m., of vehicles in and out of the central business district:

Vehicle	No. of cars.	P.C.	Movements.	P.C.
Business	29,674	67.80	252,258	84.19
Pleasure	14,089	32.20	47,352	15.81
Totals	43,763	100.	299,610	100

Of the 43,761 cars, 19,713 or 45 per cent went over the Rush St. bridge.

Vehicle	No. of cars.	P.C.	Movements.	P.C.
Business	13,367	67.30	70,760	86.87
Pleasure	6,346	32.70	10,689	13.13
Totals	19,713	100.	81,449	100

Structural Engineers Required to Pass Examination

It is interesting to note that a notice has recently been issued by the Illinois Committee of Examiners for the purpose of the examination of applicants who desire to practice structural engineering in the State of Illinois. The examinations will be held in the rooms of the Western Society of Engineers, Chicago on July 23, 1918. While the licensing of structural engineers in Canada is a matter on which considerable difference of opinion exists, it would doubtless raise the standard of the profession and afford the public more protection.

Mr. W. R. Hannan, formerly of the Deakin Construction Company, Quebec, has joined the staff of the Asbestos Manufacturing Company, Montreal.

Feeding Garbage to Hogs—A Model Contract

IN view of the discussion on feeding garbage to hogs, which matter has been given more prominent attention on account of present food conditions it is interesting to note a form of contract recently made by a United States city with the contractor. This contractor collects and disposes of the garbage, pays the city 10 per cent on net profits and maintains a city superintendent on a salary of $1500 per annum. The text of the agreement, which appears in a recent issue of the "Engineering News-Record" and is described as a model one, is as follows:

Provisions of Model Contract.

The contract, with the omission of some legal verbiage, is as follows:

1. The word garbage shall mean all organic waste or residue of animal, fruit or other vegetable matter from kitchens and dining rooms, or from the preparation of, dealing in or storage of meats, fowls, fruits, grains and vegetables.

2. For the exclusive right hereinafter granted, the contractor agrees that he will, at his own expense, collect, remove and dispose of all accumulations of garbage within the corporate limits of the City of Wichita, which garbage shall be placed by said inhabitants in conformity with the ordinances of said city, so as to be reasonably accessible to the wagons or vehicles of the contractor. Said garbage shall be taken by the contractor to such place or places as will meet with the approval of the commissioners of the City of Wichita, and shall be by said contractor disposed of by feeding to swine, under the provisions and intent of this contract, and under the conditions as shall be in strict conformity with ordnances now existing, or with such reasonable ordinances as shall hereafter be passed by the city not inconsistent with the terms of this contract.

3. The contractor shall collect and remove daily all garbage from hotels, restaurants and eating houses and from such other places, where garbage accumulates in large quantities, as may be directed by the commissioners or city manager. From residences and other places not included above, the garbage shall be removed at least twice each calendar week from Nov. 1 to April 1, and at least three times each calendar week from Apr. 1 to Nov. 1, provided, that any building or dwelling where an average of 20 persons or more are fed daily, shall be considered an eating house for the purposes of this contract.

4. All garbage, in other than residence districts, shall be collected, during the night, between sunset and sunrise, from Apr. 1 to Nov. 1., and during the remainder of the year, garbage from said districts, and throughout the year, garbage from residence districts may be collected at any time, provided that the commissioners may designate the hours for and manner of collection as in their discretion may be deemed wise and necessary.

5. The contractor, before beginning collections under this contract, shall divide the city into districts and shall deliver to the city manager a list of the boundaries of each district, and the days of the week on which he plans to make collection therefrom. The commissioners, within 30 days after the beginning of such collections, according to such districts, may make such changes, alterations and additions thereto as, in their judgment, are necessary to insure the efficiency and thoroughness of such collections. Thereafter on Nov. 1 and Apr. 1 the contractor shall revise such districts and deliver such revised lists to the city manager when they may be revised as described above. The contractor shall furnish each householder on Apr. 6 and Nov. 6 with a printed list of the days on which he will make collections, stating in such lists the time of day, as nearly as possible, when such collection will be made.

Fed on Concrete Floors.

6. The contractor shall feed the garbage on concrete floors and in a thoroughly sanitary manner and the swine shall be supplied with ample food and pure water, and properly housed in structures of wood or other suitable material, provided with ample means of being thoroughly cleaned daily; the offal from feeding floors and sleeping quarters shall be disposed of in a sanitary manner by collecting same and applying lime in sufficient quantities to prevent its becoming in any manner offensive or a nuisance.

The contractor shall feed such garbage under the supervision and inspection of a licensed veterinarian in good standing and such licensed veterinarian shall make a report of his supervision and inspection once each month to the city manager and to such other authorities as may be by law required.

7. The contractor shall, at the time of commencing operations under this agreement, make a full and true inventory of all hogs, feed, supplies and all other property, purchased, leased, owned or used in the collection, removal and feeding of the garbage, and shall at the time of each transaction promptly and accurately show upon said inventory all additions made thereto in any manner and all deductions made therefrom by sale, loss or otherwise. He shall make a true and fair market valuation of all said stock and properties at the beginning, and show in the valuation accounts kept, the names of the persons, firms or companies from whom stock, property or equipment may be bought or otherwise obtained, the prices paid therefore and the terms of purchase or procurement, the weight and count thereof and likewise show the weight, count, price and terms of all sales or other disposals of stock and property and the names of the persons, firms or companies to or through whom the said property or stock may be sold or disposed of. He shall keep a full and accurate account of all expense, costs, losses and gains incident to or derived from said business; shall keep cash and bank accounts and cause a plain and full record of every transaction to be kept and all business transacted in a manner and according to a system satisfactory to and approved by the commissioners or manager, and all files, letters received, and copies of letters written, papers, agreements and other documents and instruments together with all books, records, memoranda and other accounts shall be at all times open to inspection by the officers, manager or employees of the city delegated to examine same.

It is further agreed that within 20 days after each Jan. 1 and each July 1 following the date of this contract, the papers, files, records, books and accounts of said contractor and of the superintendent herein provided for, relating to receipts, earnings, losses, expenses, purchases, sales of stock or property, and used in the conduct and management of said business of collecting garbage and feeding and disposing of the same, shall be audited by a certified public accountant, satisfactory to the city and the contractor, and on or before the first day of February and August first following said audit, the contractor shall pay to the City of Wichita in cash 10 per cent. of the net profits from the preceding six months' business. In determining the amount of net profits for each six months no consideration shall be given to investment in real estate, plant, vehicles, teams or equipment of any kind and no allowance shall be made for interest on the investment or for working capital, nor for depreciation, nor for any interest charge upon or deduction for intangible values. Net profits shall be held to mean what is left after deducting from the gross earnings from the sale of, and the increase in value of, such swine as are fed in whole or in part, upon the garbage collected by the contractor, the necessary proper and actual cost and expense of producing the same actually paid and expended by the contractor. Said cost and expense of producing shall include the original value of the hogs, plus all expense for labor in collecting the garbage and in feeding and caring for the hogs, plus the operating expense of maintaining all plant and equipment used exclusively in collecting and disposing of the garbage and in the proper care and handling of the hogs to which said garbage is fed. Depreciation of plant, tools, teams or other equipment shall not be considered an operating expense for the purpose of this contract. The value of the hogs at any time shall be determined by the market price prevailing at that time.

8. The contractor shall save and hold harmless the city from all damage, costs and expenses of every kind, character and nature whatsoever for the payment of which the city may become liable to any person or corporation by reason of the rights and privileges herein granted to the contractor or in any wise accruing by reason of this contract, or the work done under the provisions hereof.

And in the event of the breach of this agreement by the contractor then said contractor shall save and hold the city harmless from all expenses incurred by reason of said breach not exceeding the sum of $15,000 and said contractor shall at the execution of this contract, execute and deliver to the city a surety bond to be approved by the city in the sum of $15,000, conditioned that the contractor will comply with all of the conditions and requirements of this contract.

9. That in consideration of the services to be performed by the contractor, the city gives to the contractor the exclusive right for the period of three years to collect, remove and dispose of all garbage accumulated and deposited by the inhabitants of the city in accordance with the ordinances of said city governing such disposal.

10. That the city will have in force and effect during the continuance of this contract ordinances requiring the exclusion from garbage, by the inhabitants of the city, of all deleterious matter such as glass, tin cans, paper, ashes, poisons, or other matter destructive or injurious to animal life; and requiring the placing of such garbage in proper receptacles reasonably convenient to access by the collecting wagons or vehicles of the contractor. Provided, however, that the city shall not be liable to said contractor for the violation of the terms of said ordinance or ordinances by any person, firm or corporation subject thereto, nor shall the said contractor be entitled to any deduction from the consideration due the city, as herein specified, on account of any such failure.

Contractor Pays for City.

11. The city shall have the privilege of employing a superintendent who shall have access daily to all bills, statements, papers, correspondence, files, records, books and accounts kept by the contractor pertaining to the business contemplated by this contract The superintendent shall make reports to the city commissioners as may be required. The contractor shall provide the superintendent with telephone and office facilities such as will enable him to keep proper records and maintain a close and accurate supervision and knowledge of the work of collection and disposal, together with all expenditures and collections made by said contractor. The contractor shall also furnish and maintain a proper vehicle or machine for the use of said superintendent, to enable him to respond to all complaints from the residents of the city, and to superintend properly and require prompt and efficient performance of the requirements of this contract. The contractor shall pay the salary and reasonable expenses of said superintendent, which salary shall not exceed the sum of $125 per month.

12. In event the contractor shall fail, neglect or refuse to comply with any of the terms, conditions or obligations of this contract, the city may at its option declare said contract to be terminated, null and void. In event of the omission or failure or neglect of the contractor to comply with any of the said provisions hereof, the city shall first cause to be delivered to the contractor a notice stating the particular in which said contract is alleged to have been violated and if the contractor shall not within ten days thereafter comply with said provisions then this contract shall, at the option of the city, be terminated as to the benefits and interests in favor of the contractor, and the city may take such steps as its commissioners or manager may deem advisable or proper to protect the city and its inhabitants and to provide the service contracted for herein, and collect from said contractor and his bondsmen all cost, expenses and damage resulting from such failure and efforts of the city to correct the same.

13. In the event of the termination or forfeiture of this contract, or at the expiration of the terms herein specified, the parties thereto shall mutually adjust the accounts and the contractor shall pay immediately the sum found to be due. And in event the parties are unable to agree, then the amount due the city shall be determined by three disinterested arbitrators, one to be selected by each of said parties and those two to select the third.

The Brunner-Mond Co. recently commenced work on the purification plant at Amherstburg, Ont., which, by agreement, is to supply filtered water to the town as well as to the company's plant. The major part of the excavation has been done by a large steam shovel and a number of teams, a stiff-leg derrick equipped with a bucket being used on the remainder. The concrete work, it is understood, is just about to start. An electrically-driven mixer and a tower and chutes will be employed. A trenching machine will carry out the excavation work for the pipe lines.

Stress Calculations for Guy Anchors

DIFFICULTY is frequently experienced in determining how deep in the earth guy anchors have to be buried in order to resist the maximum stress to which they may be subjected. In an interesting article by Mr. G. E. Jansson in the "Engineering & Cement World," a formula is developed which the writer states will give fairly good results for general purposes:

In Fig. 1 is illustrated the way in which a guy anchor will be pulled out. Now, if δ is the angle of the guy wire with the earth, and the earth wedge resisting the pull is xyz, then the line yz will practically divide the angle δ in two. Hence, from Fig. 2 we obtain,

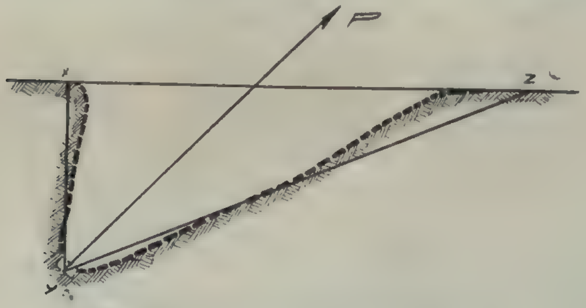


Fig. 1—Showing how guy anchor pulls out.

$a = h/\tan \delta/2$, and the area $A = \frac{1}{2} a h = h^2/(2 \tan \delta/2)$

But the weight $W = wQ$, and $Q = lA$, thus $W = w\, l\, h^2/(2 \tan \delta/2)$

where w is the weight of 1 cubic foot of earth and l is the length of the anchor bar.

Now the force necessary to overcome the friction of this wedge of earth on the slope yz is expressed by the equation

$$F_1 = f\, W \cos \delta/2$$

where f is the coefficient of friction.

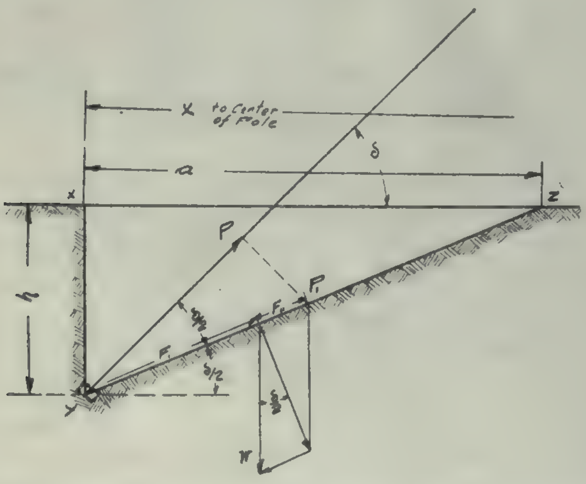


Fig. 2—Diagram of forces exerted by and upon the earth and anchor.

The gravity force acting downward is given by,

$$F_{11} = W \sin \delta/2$$

hence the pull necessary to move the wedge upwards is,

$$P_1 = F_1 + F_{11} = W\, (f \cos \delta/2 + \sin \delta/2).$$

But as the pull on the guy wire is not in the direction of the slope yz, the force P_1 must be reduced due to the upward direction of the pull, as is expressed by,

$$P = P_1 \cos \delta/2 = w\, h\, l^2/(2 \tan \delta/2)\ (f \cos \delta/2 + \sin \delta/2) \cos \delta/2$$

The friction constant as given in engineering handbooks, varies somewhat as follows:

Dry sand, clay and mixed earth....f=0.4 to 1.0
Damp clay .. ..f=1.0
Wet clay .. ..f=0.3

The curves in Fig. 3 give the value of the resisting moment in pounds per foot length of the anchor bar. Assume, for instance, that a pull of 20,000 pounds at an angle of 45 degrees is to be resisted by an anchor of 10 ft. in length, with a factor of safety of 5. We then have 5/10 x 20,000=10,000 pounds per foot length of anchor. From the curve for $\delta = 45$ degrees, it is found that h is 10.3 ft., which is the necessary depth to which the bar is to be buried. The distance x from the centre of the pole to the anchor is then expressed by

$$x = (l + h)/\tan \delta$$

where l is the height from earth to the guy wire on the pole.

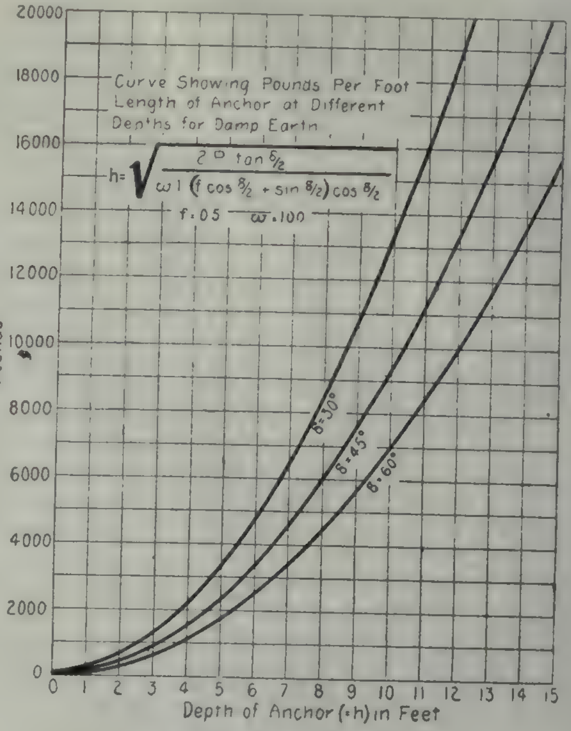


Fig. 3—Resisting Moment Curves.

The reorganization of the various departments of the city of Montreal will affect the building and engineering sections. The Administrative Commissioners have terminated the engagements of Mr. Alcide Chausse, the city architect and superintendent of building, who has been in the city's service for 19 years; Mr. J. R. Barlow, superintending engineer of the roads department, in the employ of the city 42 years; Mr. J. P. Garnon, general superintendent of the roads department; Mr. N. Boileau, secretary of the building department. The notices become effective on August 1. Mr. Barlow will receive a pension.

The New Hotel Brunswick

A new hotel is in course of erection in Moncton, N.B., for the Hotel Brunswick Co., Ltd. The site, at the corner of Main and Highfield streets near the Government Railway Station, is an ideal one for the purpose.

The building is six storeys in height, of solid stock brick construction on a concrete foundation, and when completed will contain 120 guest rooms and 40 bathrooms; all these are so arranged as to have direct light. The main entrance is on Main Street, the frontage on this street being 96 feet, and the building extends to a depth of 100 feet on Highfield Street.

The ground floor provides for a large lobby 25 x 50 feet, men's and ladies' writing rooms; the main dining room, 36 x 56 feet; one private dining room; a Palm room, 25 x 35 feet; a barber shop; manager's offices; elevator; telephone booths; the kitchen, with its service rooms, etc. The lobby and halls will have tile floors and will be finished with clear birch panelling. A large fireplace will be built into one end of the room finished with rustic bricks, and an enamelled drinking fountain will be provided.

The basement will contain a billiard room, and a large toilet room for men, finished with glazed tiles; also the furnace and fuel room, the laundry, and the stores, vegetable cellars, etc., in connection with the kitchen.

On the second floor there will be a large ladies' parlor, opening on a terrace over the main verandah.

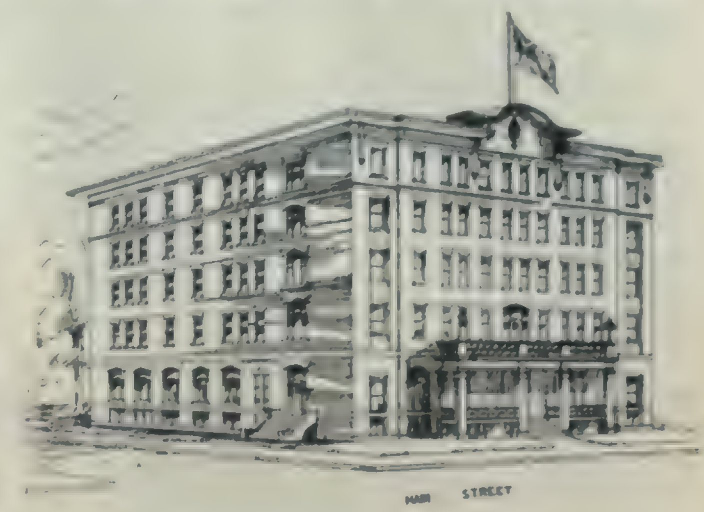
Progress view new Hotel Brunswick, Moncton, N.B.

The balance of the second floor and all other floors will be occupied by the guests' rooms, all of which will have running cold and hot water, a private telephone, etc. The general finish of these rooms will be Douglas fir stained and varnished, with hardwood floor, except in the private bathrooms, where there will be tiles.

On every floor excepting the ground floor there will be suites of three and two rooms, with bathroom attached, and provided with a fireplace, etc. All floors and stairways will be either of tiles or hardwood.

The kitchen will have special equipment, such as an electric dish washer, peeler, etc. The refrigerating plant will be electrically operated and will contain six boxes.

Mr. R. A. Frechet, A.A.P.Q., of Moncton, is the architect for the building, and Mr. James Reid, the well-known Moncton contractor, has the general contract for its erection. Sub-contracts were awarded as follows: Plumbing and heating, the Sumner Company; mill work, Murray & Gregory, of St. John; framing and general lumber, D. Lockard, of Humphrey's Mills.



Hotel Brunswick—R. A. Frechet, architect.

New Type of House Combines Speed and Ease of Erection

THE need for some type of construction which will reduce the cost of building, as well as combine a speedy solution of the present need for houses, has resulted in a number of different methods, including the poured monolithic and the precast concrete section type. This class of house also offers considerable scope for architectural adornment, at an additional cost which would not be appreciable. A new type, called the cement stud and cement stucco construction, is described in the following article in the American Architect:—

After the cellar has been excavated a stone or concrete foundation is built. If of concrete, it is poured from a travelling mixer, with loader, into wooden forms, made in panels, so as to be easily removable. The first floor wood joists are then set in place on the foundation wall. On these a wooden frame, consisting of studs, joists, and rafters, is erected in the usual manner adopted in building the skeleton of a wood-framed house. Every fourth stud is doubled, allowing a three-inch by four-inch space between, which is filled with concrete to form a concrete stud. At the second floor and roof levels a ledger board, with bottom attached, is placed over the studs, and so arranged that, when filled with concrete, they form beams which, with the vertical concrete studs, make a homogeneous concrete frame. The concrete studs, when completed, are continuous from foundation to top. On top of the lower ledger board the second-floor joists are set, then the second-storey studs, and so on. When this frame is completed, including the party wall, and the roof is on, heavy waterproof paper is nailed to the outside of the exterior wall studs, leaving the space between the double studs open to receive the concrete. Over the waterproof paper the metal lath or concrete reinforcement is stretched. The concrete studs are reinforced with steel rods fastened to the metal lath. The ledger boards have a bottom wood piece or form, so that when filled with concrete they act as beams to carry the floor joists and roof rafters. The wood studs act in the dual capacity of supporters of the cement stucco while it is being applied and as furring strips on the finished building.

Then a thick concrete coating, one and one-half to two inches thick, is given to the exterior by means of the cement gun filling the space between the doubled studs to form the continuous vertical stud. If the cement gun is not available the continuous vertical studs and ledger boards can be poured with concrete and the exterior metal lath coated with cement by hand. The concrete is 33 per cent. denser than ordinary poured concrete and about twice as strong. Color effects can be produced by adding mortar-stain to the concrete when mixing it.

The chief points urged in favor of the method described are:—First, after the framework of any number of houses is erected the cement can be applied without interruption, instead of stuccoing part of the work, and shifting the laborers and material to another portion thereof while the first is being completed, and then having to shift them back again. Secondly, the numerous cracks common to all other methods of concrete construction are eliminated, because the vertical concrete studs carry all the load, so that there is no shrinkage or settlement to contend with in this monolithic structure. Party walls merely have a skim coat of white plaster applied to the cement for a finish, which makes a saving on this wall alone of at least twopence per square foot over the usual plastered surface.

The fundamental idea involved is to produce a cheap, semi-fireproof house, i.e., one which may be built with the same rapidity and cost as an all-wood structure. If it is desired to increase the fire-resisting qualities of the building, metal lath, instead of wood lath, may be used on interior surfaces which are to be plastered.

The roof, whether flat or pitched, lends itself very readily to concrete construction. The concrete may be applied in the same manner as before described for the vertical walls, but the expensiveness of the concrete roof construction necessary to carry the roof itself makes it prohibitive for the type of building in which low cost is a prime essential. For the pitched roof there are other good, economical, and easily obtainable fire-resisting materials, including asbestos and asphalted-felt shingles, and built-up roofings of felt, tar, and gravel.

If, as is claimed, a house can be thus completely concreted in two and one-half days the possibilities in rapidity of construction by this process are apparent.

Mr. G. R. MacLeod, engineer in charge of the sewer department and railway affairs of the city of Montreal, who has spent six months in Washington in connection with the Imperial Munitions Board and the Canada War Mission, has returned to his duties in Montreal.

Lieut. Geo. D. McLeod, youngest son of the late Prof. McLeod, for many years secretary of the Engineering Institute of Canada, is a prisoner of war in Germany. He joined the Royal Air Force in April, 1917.

New Features in Concrete Road Making

SOME new features of concrete road construction are discussed by Mr. Charles M. Upham in a paper read before the American Road Builders' Association: In concrete road construction several new features have been devised in the last few years. Probably the one that is now demanding the widest attention is the use of a hand roller in finishing the concrete. It is stated that slabs finished with the roller develop considerably more strength than slabs finished by an ordinary float. Not only does the roller increase the strength of the concrete, but it is stated that it also takes out the short waves that cause considerable vibration to traffic in passing over the pavement. A common way of manipulating the roller is to move it transversely across the pavement a certain period after it is struck off with the template. The effect of the roller is to consolidate the top layer of the concrete and remove the surplus water and take out the slightly uneven places that have been left by the template. Experience will show best the right amount of rolling. After the pavement is rolled, it is ready to be finished with a canvas belt.

In riding over concrete roads it has been found sometimes that there is considerable vibration or unevenness. This is a serious objection which should and can be overcome. On roads that have been constructed for some time a good part of this is due undoubtedly to the fact that sufficient care was not taken in finishing. It has been found that, even with extreme care with the template and in hand floating, there are still numerous waves in the concrete surface, and it is stated that it is practically impossible to get rid of this. After experimenting with various finishes, it has been found that the smoothness and evenness of the surface are practically determined by the condition of the side forms. A form that keeps a true alignment and is not easily bent and can be kept in a straight line is the one that will produce the smoothest pavement.

A new feature in the maintenance of concrete roads is the use of a tar kettle upon which are mounted a pump and hose. Considerable time is saved by the pump and hose, and a large mileage of concrete pavement can be maintained in a short time.

Another new feature in concrete construction is the resurfacing of an old concrete road with a concrete surface. This is now familiar to all highway engineers, and has practically been accepted as being a satisfactory method of resurfacing.

Use of Hydrated Lime

In the construction of concrete roads the use of hydrated lime has received considerable attention. It appears that hydrated lime does not have the same effect upon different proportions of concrete, nor does it have the same effect upon different sands. It appears from the results that lime is not as beneficial to the stronger or weaker mixtures of concrete as it is to the intermediate. In other words, hydrated lime is found to be beneficial to the strength of concrete when used within certain limits.

It is practically now accepted by all engineers that the aggregate in concrete should be mixed for at least one minute. Certain experiments seem to show that continued mixing increases the strength up to four minutes. It appears, however, that the most economic time is between one minute and one minute and a half.

The question of joints seems to be one that has demanded considerable attention, and it is now almost the general method to place a joint only at closing of work for the day, or no joint at all. Many experiments have been carried out by making each day's work as one large slab without a limit to its length. While no bad effects have resulted from this, it does not mean that transverse cracks are eliminated entirely. Inasmuch as it seems practically impossible to eliminate entirely these transverse cracks, it is considered good practice to regulate and provide a place of weakness in the pavement by placing a blind wooden joint underneath the surface at intervals from 50 ft. to 200 ft. apart. This regulates the location of the transverse cracks to a certain extent and makes possible a straight line crack instead of an irregular one. As a word of caution, there is a danger in not getting the wooden joints vertical. This would create a tendency for one slab to rise above the next. One other method that seems to be satisfactory and will insure no possibility of one slab rising above the other is to tie the different slabs together by iron rods which have been coated with tar or asphalt. This allows the concrete to contract and re-expand, but will not let one slab rise above the other. In this case the joint is treated and maintained exactly the same as a crack.

The use of calcium chloride in concrete, while not exactly new, is one that is creating quite an interest. Sufficient data are not available to show the ultimate results this may have on concrete roads.

Measuring Aggregates

In the construction of concrete a new feature that has greatly reduced the cost of construction and assisted in producing a more perfect concrete road is the method of measuring the aggregate at the point of supply and carrying them to the concrete mixer in containers each holding one batch. Upon arriving at the mixer the concrete ingredients are dumped into the hopper in one operation and then mixed and placed in the regular way. This method does away with the placing of the aggregates on the subgrade, which would mean that a considerable part of the aggregate is lost and that the subgrade could not be kept in as good condition as with the central distribution method. It also means that the aggregates are kept much cleaner, which means that the finished concrete is so much better. It also means that the labor operation of loading the concrete ingredients from the subgrade into the hopper is entirely eliminated. Several methods have been devised to carry out this system, but probably the most satisfactory one is the use of rails for hauling the containers which carry the aggregates to the mixer. The container is taken from the car and emptied into the hopper by means of a derrick attached to the concrete mixer.

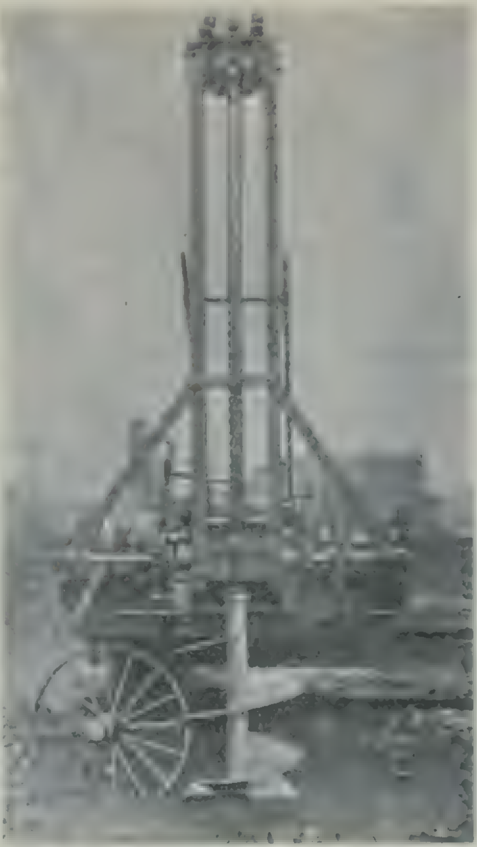
Boring Machine for Pole Holes

A NEW machine which should help in the labor shortage situation is one designed for boring pole holes. The machine and some of its details are shown in the accompanying illustration. The boring machinery is mounted upon a steel roller-bearing hub truck which has a weight carrying capacity of 10,500 pounds. It consists of a turntable, 5ft. by 12 ft., upon which is mounted a series of gears, sprockets and clutches connected by chains to a tower arrangement by means of which the turning power and pressure is applied to the earth auger. The tower may be lowered so as not to come in contact with low bridges, wires, etc., when the truck is moved.

The equipment is so balanced upon the turntable that it may be swung around to any point of boring and also may be adjusted for boring on hills or inclines at an angle of 15 to 20 degrees.

The motive power for this particular model consists of a 40 horse power motor. Its connection with the gearing of the boring equipment is by means of a heavy sprocket chain.

Two levers are provided for operating the auger, one controlling the speed and the other for raising and lowering the auger. When boring in the ground, the speed is about 10 feet a minute and when raising from the hole 25 to 50 feet. The machinery is controlled from the point of boring at the rear of the turntable, as indicated in the illustration. When boring, the auger is cleared of earth from the hole through centrifugal force. Only two men are required for operating the machine.



In the tests of the machine illustrated, 24-inch holes 6 feet in depth were bored through clay and rock in 4½ minutes. In the final test holes of the same dimensions were bored in clay soil in from 1½ to 2 minutes; in loam, sand and rock, in three-fourths of a minute. In all these tests there was severe stress and strain to which the machine stood up satisfactorily.

A test has been made of digging the hole in adobe and hard-pan soil and placing the pole, the time being five minutes. The efficiency of the earth boring machine is claimed to be an average of 100 poles in a 10-

hour day or 10 poles an hour. This includes digging the hole, setting the pole and moving from one point to another.

Provision is made for equipping the earth-boring machine with a derrick for raising poles from the ground and lowering them into the holes. Augers of various sizes from three inches to 30 inches may be used with satisfactory results. The holes bored by this equipment are uniform and clean cut, and the soil removed from the holes is well broken up for tamping purposes.

In addition to the use of the machine for pole-line construction work, it may be advantageously utilized in digging trenches for underground conduit. For this purpose a series of holes, close together, may be bored and then the intervening walls removed, thus forming the trench.

Modern Appliances Used in Shipyards

SHIP construction all along the Pacific Coast from Vancouver to San Francisco during the past year has jumped forward by leaps and bounds. In times past, before the new speed tools were invented, it took in the neighborhood of a year, and often more, to build a good-sized steel freighter. With the advent of the pneumatic hammers and riveters, oxy-acetylene burners, etc., and more modern methods generally, steel ships have been built from keel to stack in as short a time as thirty days, and the record is being constantly lowered on the different sizes of vessels. Frame moulds are now made in the mould-lofts for all purposes, such as marking the outline of the frames on the landing slabs, and for marking the rivet holes, positions of plates, landings, stringers, etc., on the frame after bending. The time saved by the adoption of this principle is about one-half.

Owing to the abnormal conditions prevailing at the present time there are only a few men who have a practical knowledge of shipbuilding practice, therefore the utilizing of moulds for almost all steel work tends to prevent mistakes by unskilled hands and at the same time allows the plates and steel to be fabricated in advance of the actual beginning of the work of erecting the vessel. Another point to be noted is the standardizing of the work drawings, whereby as many of the moulds as are required are available for repeat or universal work, thus making one mould do the work of several.

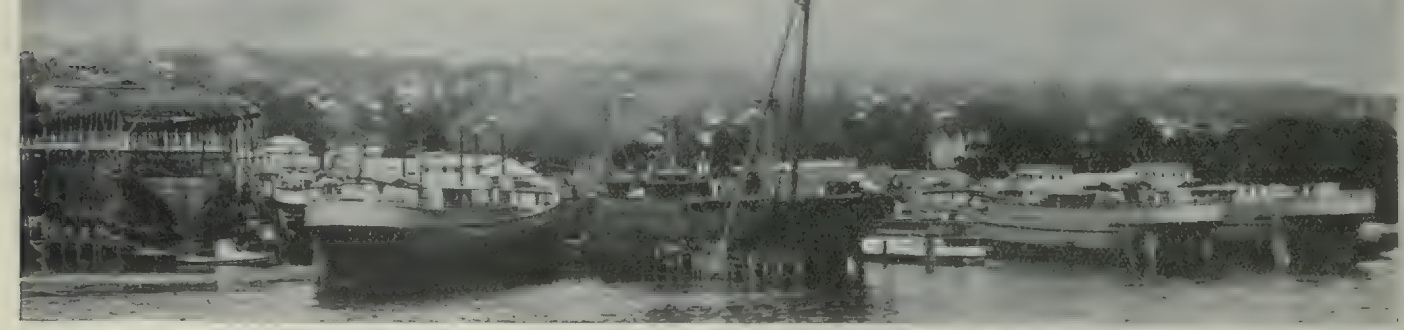
In some yards the shell plating, bulkheads, tank tops, decks, deck houses, etc., are fabricated from moulds issued from the loft, where the plates are expanded and laid out in their true shape. However this custom is not followed to the letter in most shipyards. Formerly manholes and lightening holes were punched out, which necessitated the chiseling by hand of the ragged edges; also many holes found necessary after the work was in place had to be hand-cut, which was a slow and difficult method. This has been done away with by the use of oxy-acetylene torches, which cut the holes in very much shorter time and in a way that obviates all trimming. Hand hammers have been almost relegated to the junk pile by the use of the automatic compressed-air-driven type. Pneumatic hand tools for caulking, cutting and chipping have taken the place of the old hammers and chisels. Permanent rollers have been fitted to the punching machines, so that where half-a-dozen men were formerly required to feed the machine, the work is now done by one man. Instead of following the former system of niching the sections of plate with a chisel and quarter hammer, and then breaking off the fragments, circular saws of mild steel, driven at high speed, are used for the cutting of shapes, such as channels, T-bars, H-sections, etc.

On the whole it may be said the demand for rapid delivery of steel cargo vessels to offset the work of the sea-raiders has created an urgency for the installation of every modern appliance in ship construction not dreamed of five years ago. That this necessity is being so quickly met speaks well for the scientific engineering ability of the nation.

Below is a photo of the Wallace Shipyards, North Vancouver. In the gantry, to the left, can be seen the stern of Number 99, a 4800-ton steel cargo carrier being built for the J. Chambers Co. of Liverpool, Eng. In the centre is the big steel freighter, "War Power," built and entirely equipped in the Wallace Yards. On the left and right are three 2,500-ton wooden schooners built by other Coast yards, but docked at this yard to receive their 1,000-h.p. engines and all auxiliary machinery. The Wallace Shipbuilding Company has a contract to build five steel cargo vessels for the Dominion government and expects to commence work on this order at an early date.

The Hun in Canada

THAT there is an organized system of destruction operating in Canada and the United States as part of the German scheme for winning the war is not doubted by those in the best position to know. Hundom knows full well the paralyzing effect of strikes and sabotage, fires, explosions, damage and destruction to industrial plants, particularly those



Wallace Shipyards, North Vancouver, B.C.—Five ships shown under construction.

engaged in producing anything needed in war. Recently we have read of great contracts of completed army clothing worth millions of dollars, totally destroyed in a fire started mysteriously in St. Louis, Mo. Explosions are frequent, bombs are placed with a skill and certainty that speaks volumes for the facilities and resource of the enemy's agents in our midst.

There are plants in Canada to-day, the destruction of which would be worth an army corps to the Kaiser. They will be destroyed if enemy agents can do it. Some of them have been damaged or wiped out within the last year. The great automobile, munitions, shipbuilding and other plants in the United States engaged in war work are now being enclosed in a new type of thick wire fence seven feet high and crowned with a triple string of barbed wire overhanging at an angle that prevents any would-be intruder from surmounting the obstruction. This protective chain-link fence surrounds the entire plant, thus creating a positive zone of safety about the premises. At stated places, similarly protected entrances and exits are placed, so that all ingoing and all outcoming is centralized, and each person may be scrutinized before entry is granted.

In Canada, this new protective fence is being erected in miles by the Dennis Wire & Iron Works Co. They state that recently, safety zone fence has been erected around such plants as the Quaker Oats Co., Peterboro; Dominion Steel Products Co., Brantford; H. Mueller Mfg. Co., Sarnia; power plants at Niagara Falls, St. Catharines and Welland and many munition plants at these places and elsewhere. For the information of those interested, the Dennis firm have published an illustrated folder which will be sent free on application.

New Members E.I.C.

The following members, associate members, etc., of the Engineering Institute of Canada have been elected:

Members—Messrs. Kay, Alexander, Vancouver, chief engineer and superintendent of construction with Grant Smith & Co., and McDonnell, Ltd., at present Major C.R.T. France; J. E. Brown, Ottawa, general manager of Ottawa Hydro-electric Commission; G. M. Colvocoresses, Humboldt, Arizona, U.S.A., general manager and consulting engineer for Consolidated Arizona Smelting Co. and the Ohio Copper Co., of Utah, and Nicu Steel Corporation, Ltd.; C. B. Hamilton, Jr., Toronto, munition work, shells, and fine precision gauges and tools

Associate members—Messrs. S. A. Button, Virden, Man., district engineer, Manitoba Government on Good Roads Board staff; F. H. Kester, Walkerville, Ont., acting designing engineer for the Canadian Bridge Co., with responsibility for designs of steel work for railway and highway bridges, factory and office buildings, etc.; E. H. Longley, New Westminster, B.C., chief examiner for the Imperial Ministry of Munitions, general car plant, Montmagny, P.Q., in charge of plant engaged on war work; E. A. Markham, Regina, Sask., superintendent of construction for the Parsons Construction Co., Regina; C. M. Walker, Ottawa, Topographical Surveys Branch, Department of Interior, Ottawa.

Junior—Mr. J. P. Mooney, St. John, N.B., in charge of the managerial end of the business of B. Mooney & Sons, general contractors, brick manufacturers, and granite quarry operators.

Transferred from associate members to members—Messrs. Raoul de B. Corriveau, Ottawa, district engineer, Public Works Department, directing investigation and reporting on matters pertaining to the control, regulation and improvement of rivers and harbors; R. B. Stewart, New Glasgow, N.S., manager and engineer, Maritime Bridge Company, Ltd., New Glasgow, N.S.

Transferred from juniors to associate members—Mr. W. E. Bond, Toronto, assistant engineer, Department of Public Works, on Toronto harbour improvements; F. M. Brickenden, London, Ont., officer with Canadian Engineers on active service in France, was previously engaged on layout and construction of highway bridge, pavements and sanitary and stone sewers, representing the City Engineer of London.

Transferred from student to junior—S. A. Neilson, Westmount, P.Q., resident engineer with the Hull Electric Company, P.Q.

Determining Water Content of Soil

IN almost any engineering project the character of the soil has to be ascertained. The stability of the soil is due in varying amount to the percentage of water present as well as to the nature of the material composing the formation. In testing for a suitable foundation, especially in the case of heavy bridge piers and building footings, the usual method has been to take soundings or sink test pits and borings until hard pan or solid rock has been reached. No attempt has been made to determine the water content in surrounding soil. In all irrigation and waterworks projects as well as sewer systems, it is important to determine the water holding capacity of the soil in order to compute the run-off in the area under consideration. The results of some experiments in this connection carried out by Prof. C. E. Thorn of the Washington Agricultural College were recently read at a meeting of Idaho engineers.

The experiments, which refer only to one particular soil strata, might be extensively developed in other formations, and were carried out as follows:

Three sets of furrows were made on a field of average slope and soil, underlaid by hardpan about 2 ft. below the surface. The field had not been irrigated for several weeks and the top soil was very dry. Each set consisted of three furrows, 300 ft. long. At the head and foot and at each 100-ft. interval they were drawn together and a 4-in weir installed. On set A the furrows were 3½ in. deep and 20 in. apart. A flow of 1.4 miner's inches at the head was divided among three furrows. Water ran through the first 100 ft. in 20 minutes, 200 ft. in 1 hour and 300 ft. in 3 hours and 10 minutes. The furrows were wet across and practically the same quantity wasted out the lower end as was going in at the head in 5½ hours.

On set B the furrows were 30 in. apart and 3½ in. deep. Two miner's inches were divided among the three furrows. The progress of the water was 100 ft. in 10 minutes, 200 ft. in 30 minutes, and 300 ft. in 50 minutes. Ground was wet across between furrows in 7½ hours and the soil taking practically no more water in 8½ hours.

Set C were 6 in. deep and 30 in. apart. Two inches were run in the three furrows. The water ran all the way through in an hour. Ground was wet across in 6½ hours, and full to saturation in 7½ hours.

The Columbia Engineering Works has registered in British Columbia as an extra-provincial company, establishing its local headquarters at Vancouver. The head office of this firm is in Portland, Ore.

England's First Concrete Ship

The first large concrete vessel ever produced in England will very shortly pass into the service of the Government. She has a displacement of about 900 tons, and a dead-weight carrying capacity of some 400 to 500 tons. She follows the lines of an ordinary steel ship, and has a pleasing appearance.

New Chief Engineer of C.P.R.

MR. J. M. R. Fairbairn, M.E.I.C., has been appointed chief engineer of the C.P.R., in succession to Mr. J. G. Sullivan, M.E.I.C., who has retired to enter private practice, but who will retain his connection with the company in the capacity of consulting engineer. Mr. Fairbairn has been connected with the C.P.R. since 1892, although his service has not been continuous since that date. Born in Peterborough in 1873, he began his professional career in 1890 on surveys on the Otonabee River, and in the same year commenced a course of civil engineering at the Ontario School of Practical Science, Toronto. During the summer of 1892 he was a leveller and topographer on the preliminary and local surveys for the Peterborough, Parry Sound and Sault Ste. Marie Railway, under the late Mr. W. A. Ramsay, chief engineer of construction for the C.P.R. In May of the following year he graduated in civil engineering from the School of Practical Science. From 1893 to 1895 Mr. Fairbairn was engaged on work for the Departments of the Interior, Militia & Defense, and Railways & Canals, while in 1896 he had charge of the construction of the Lachine & St. Laurent lines of the Montreal Park & Island Railway Company. He then located in British Columbia, and in 1897-8 was on mining work in the Slocan district, and on passing as a provincial land surveyor went into private practice at Greenwood, on land, mining claims, and surveys.

Mr. J. M. R. Fairbairn.

August, 1900, saw Mr. Fairbairn back with the C.P.R. on work as leveller on the grade reduction surveys between Winnipeg and Port Arthur. After a short period as engineer in charge of a section of the Simcoe-Balsam Lake division of the Trent Canal, Mr. Fairbairn was appointed resident engineer of the C.P.R., Ottawa. He subsequently occupied the following other positions with the company—assistant engineer in chief engineer's office, Montreal; division engineer, Ontario division, Toronto; division engineer, Eastern division, Montreal; and assistant chief engineer, Montreal.

Mr. Fairbairn joined the Engineering Institute of Canada as associate member in 1899, and became a full member in 1908. He has been a member of the Council.

With the exception of one break, Mr. Sullivan has been associated with the C. P. R. since 1895. In 1908 he was appointed assistant chief engineer, and in 1911 was transferred to Winnipeg, becoming chief engineer in the same year. Mr. Sullivan was responsible for one of the most notable engineering works on the continent—the construction of the Connaught Tunnel, and he also carried out the great irrigation works in Southern Alberta.

Montreal City Roadway Costs

THE Administrative Commission of Montreal have been in conference with the representatives of the Montreal Light, Heat & Power Consolidated, Montreal Water & Power Co., Bell Telephone Co., Public Service Corporation, Montreal Tramways Co., and Dominion Gresham Guarantee Co., on the subject of repairing breaks in the streets. It was agreed to abolish the old fixed rate of $2.50 a cubic yard paid by the companies, and that the latter pay the actual cost of repairing the roadways after the excavations have been made. With a view to the general convenience, it has been arranged that the companies make deposits of lump sums; when a company applies to break up a road, an estimate of the cost of repair will be made by the engineering department of the city, and the permit granted if there be sufficient money on deposit to cover the cost. No road is to be broken up without a permit, except in very exceptional circumstances, such as breaking of water or gas mains.

Mainly Constructional

East and West—From Coast to Coast

The city of Chatham, Ont., has agreed to co-operate with Kent county in a suburban good roads' scheme under the provisions of the Ontario Highway Act.

A permit was recently issued to the Ogilvie Company for the erection of an eleven-storey cleaning elevator as an addition to their plant in Winnipeg, Man. The estimated cost is $250,000.

Building permits issued in Welland County, Ont., for the month of June show a big increase over the same month last year, the figures being $96,715 and $22,530, respectively. The total for the first six months of this year is $273,439, as compared with $155,725 for the corresponding period in 1917.

At a recent meeting the council of York County, Ont., passed a by-law to provide for the extension of the good roads system further in North York, thus including another 100 miles of roads. A by-law was also carried to raise $45,000, the share of the county in this year's highway programme, and a further sum for maintenance work.

The building permits issued in Toronto during the first six months of the year show an increase of $415,237 over the corresponding period last year. The figures are, respectively

$3,741,015 and $3,325,778. In June of this year, the value of the permits was $1,005,014, as compared with $629,794 for the same month of 1917.

The Ontario Hydro-electric Commission has just acquired through the Canadian Equipment Co., Ltd., Montreal, two additional Bucyrus electrically operated shovels, making a total of 8 shovels sold to the Commission. These are used in connection with the new 300,000 h.p. plant of the Commission, which was described in a recent issue of the Contract Record.

The Department of Railways has commenced improvement work on the Stanley branch railway in New Brunswick, running between Cross Creek and Stanley. This line was lately taken over from the York & Carleton Ry. Co. The work being done includes the placing of heavy rails and new ties, and grading. The number of new ties to be laid is about 18,000.

Included in the long list of enterprises incorporated under the B. C. Companies' Act are the following: Eburne Steel Co., Ltd., head office at Eburne, Vancouver district, with capital of $100,000; Basque Chemical Production Co., Ltd., head office at Vancouver, capitalized at $150,000; the Vickers Contracting Co., Ltd., head office at Vancouver, capitalized at $10,000.

The Defiance Packing Co., Ltd., Vancouver, through its general manager, A. H. Sherman, has obtained permission from the Vancouver City Council to build a packing plant to cost $50,000 instead of one which called for an expenditure of only $7,500. The building will be three storeys, of heavy mill construction, and will be equipped with elevator and expensive refrigerating machinery to care for one million pounds of fish.

The Kipawa Fibre Company, which is associated with the Riordon Pulp & Paper Co., has broken ground for its new mill site, south of Lake Temiskaming, in the Province of Quebec, at what is called Lumsden Mills, near Kipawa Lake. There is 20,000 h.p. of available power and the company has some 20,000 square miles of timber lands for the supply of pulp. It is proposed to erect a mill with a capacity for 100 tons of bleached sulphite pulp every 24 hours. The town and mill site will cover about ten square miles.

The Canadian Association of Stationary Engineers elected the following officers for the ensuing year at their recent convention in London, Ont.: Past president, R. F. Gofton, Kitchener; president, W. M. Cooke, Belleville, Ont.; first vice-president, George E. Hall; second vice-president, I. J. Tait, Montreal; third vice-president, Daniel L. Webster, Brantford; secretary, John H. Hale, Hamilton, (re-elected); treasurer, Alfred W. Roath, Hamilton, Ont., (re-elected); conductor, Charles Berry, Ottawa; door-keeper, A. R. Taylor, Toronto. A past president's jewel was presented to R. F. Gofton. Next year's convention will be at Brantford.

The government are extending their plans in connection with the establishment of a district depot in North Rosedale, Toronto. One million dollars is to be spent on the new scheme, and it is understood that provision will be made for accommodating 3,000 men. Immediately north of the St. Andrew's College property, which is being taken over for military hospital purposes, is a tract of land acquired by the government at the time of the purchase of the C.N.R. This land, and probably another adjoining tract, is to be used by the military authorities as the site of the district depot. Buildings of the type now in use at the Whitby Convalescent Hospital will be erected without delay.

A highway improvement association is being formed to cover the counties in eastern Ontario. The movement originated with the appointment of a good roads committee in Ottawa by various public bodies of the city following a motion by Alderman Findlay in the city council some weeks ago. This committee held a recent meeting at which representatives of the counties of Carlton and Renfrew were present, and it was resolved that a highway improvement association should be formed for the whole of eastern Ontario. The organization meeting was held in the city hall, Ottawa, on Monday evening, July 8, at 8 p.m., all municipal officials and others interested in good roads, from Frontenac county to the Quebec borders, being invited to attend.

A deputation representing Hamilton, St. Catharines, and the counties of Wentworth and Lincoln, recently interviewed the members of the Ontario Cabinet with the request that the Q. & G. road be designated as a provincial highway. Hon. F. G. Macdiarmid, Minister of Public Works and Highways, stated that he would take the matter up at once with the engineer of the department and he believed that arrangements could be made to take the road over in about a month's time. Sir William Hearst, however, made it clear that the government would undertake no capital expenditure on the highway at the present time. The Q. & G. road, as it is popularly known, joins Hamilton and Queenston, it's length being 47 miles. It is a favorite motor route and especially since the reciprocity of licenses there has been a big increase in tourist traffic.

Personals

Mr. Russel A. Stinson has been appointed a member of the Public Utilities Commission of St. Catharines, Ont., in place of Mr. H. J. McAvoy, who has resigned.

Quartermaster-Sergeant W. J. Sloan, with the C.E.F., in France, some time ago had the misfortune to be wounded in the right arm by a piece of high explosive shell. In civil life Q.M.S. Sloan is senior partner in the firm of Sloan & Harrison, building contractors, New Westminster

Mr. A. W. Campbell, who retired recently as deputy minister of railways, will, it is understood, be appointed to a position by the government in connection with a federal scheme for the improvement of the roads and highways. Mr. Campbell is an enthusiastic good roads man, having been for years at the head of the movement in Ontario.

Mr. G. E. Porter, engineer in charge of work on the famous Quebec bridge, on June 7th gave an intensely interesting account of the history of the great span to a large Vancouver audience, under the auspices of the Vancouver branch of the Engineering Institute of Canada. Mr. Porter used many slides to illustrate his lecture, showing the different stages of construction. The same lecture was repeated on June 8th at Victoria.

Messrs. Chapman and McGiffin, Architects, Toronto, have recently dissolved partnership. Mr. Alfred Chapman has removed his office from 95 King St., east, to the Harbour Commissioners' Building, foot of Bay St. Major R. B. McGiffin, who has been on active service since the outbreak of the war, has been promoted to the rank of Lt.-Col. and been placed in charge of the Engineers of No. 2 Military District, with headquarters in Toronto, Ont.

Trade Publication

The Canadian Ingersoll-Rand Co. have just issued a new catalogue of their direct lift vertical air hoists. The booklet is well illustrated, and gives complete details of the different types of valve used for various classes of work up to 5 tons' capacity — the dust proof single acting, the dust proof air balanced, the dust proof double acting. Complete tables are given, including a useful table of the free air consumption of the hoists.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Laterriere, Que.
The Town Council are constructing gravel roads costing $16,000. Engineer, J. F. Trenon.

New Brunswick, Province of
The Department of Public Works, Provincial Government, contemplate road work on North Lake Road, Nashwaak Road and Broad Road. Minister, P. J. Veniot, Fredericton.

Port Moody, B.C.
The Department of Public Works, Provincial Government, contemplate the construction of two miles of road costing $10,000. Engineer, A. E. Foreman, 1613 Belmont Ave., Victoria.

St. Catharines, Ont.
Tenders are being received addressed to the Board of Works until 5 p.m., July 18, for sewage pumping station and main for the City Council. Plans and specifications with the engineer, W. P. Near,

Schreiber, Ont.
Tenders are being received for the construction of a mining road from here to Big Duck Lake for the Duck Lake Mining Co., Ltd., 105 South May Street, Fort William.

Windsor, Ont.
Tenders are being received until July 22 by the engineer, Morris Knowles, Bank of Commerce Bldg., for the construction of an intercepting sewer for the Town Council.

York Township, Ont.
Tenders will be received until July 13 for the construction of 6-inch cast iron water mains on High Street and Kenwood Avenue for the Township Council. Engineer, F. Barber, 40 Jarvis St., Toronto.

CONTRACTS AWARDED

Blenheim Township, Ont.
Albert Moyer, Drumbo, has the general contract, and A. B. Hewitt Company, Priceton, the tile contract for the construction of the "Holdsworth" drain for the Township Council.

East Oxford Township, Ont.
A. E. Malfer and A. B. Hewitt have the general contract for tile drain for the Township Council.

Hatley Village, Que.
Edouard Prevost, Acton Vale, has the general contract for the construction of roads costing $14,000 for the Municipal Council.

Islington, Ont.
J. J. Quirk, 3 Lincoln Ave., Toronto, has the general contract for the construction of sidewalks on Canning and Islington Streets for the Village Council.

Roxborough Township, Ont.
McLean & Stidwell, Cornwall, have the general contract for drainage work costing $15,122 for the Township Council.

Ste. Anne, Man.
Loewan & Brandt, Steinbach, have the general contract for reinforced concrete culverts for the Municipal Council.

Railroads, Bridges and Wharves

Grey County, Ont.
Tenders are being received by the Road Superintendent, J. Johnston, 1240 Fourth Ave. W., Owen Sound, until 6 p.m., July 15, for the erection of two bridges for the County of Grey.

Judique, N.S.
Tenders are being received by the secretary, R. C. Desrochers, Ottawa, until noon, July 23, for the reconstruction of a portion of breakwater at McKay's Point for the Department of Public Works, Dominion Government.

Lansdowne, Mnt.
Tenders are being received by the secretary-treasurer, M. E. Boughton, Arden, until 2 p.m., July 16, for the erection of a reinforced concrete arch bridge over White Mud River for the Municipal Council.

Shediac, N.B.
Tenders are being received by the secretary, R. C. Desrochers, Ottawa, until noon, July 23, for repairs to public wharf for the Department of Public Works, Dominion Government.

CONTRACTS AWARDED

Calgary, Alta.
McDougall & Co., First St. W., have the general contract for freight sheds, etc., costing $50,000, for the Grand Trunk Pacific Railway. Architect, J. G. LeGrand.

Chicoutimi Parish, Que.
Thaddie Brisson, Chicoutimi, has the general contract for $6,000 highway bridge for the Town Council.

Levis, Que.
C. H. Jackson & Co., 34 Dalhousie St., Quebec, and the National Cartage & Supply Co., Ltd., 18 Seventh Street, Limoilou, have the general contract for reconstruction of electric railway at a cost of $14,000, for the Levis County Railway, Commercial St., Levis.

Fort William, Ont.
Carter-Halls-Aldinger Co., 1010 Union Bank Bldg., Winnipeg, have the general contract for $10,000 extension to roundhouse for the Canadian Pacific Railway, head office, Montreal.

St. Basile Le Grand, Que.
W. E. Poulin, Marieville, has the general contract for concrete bridge for the Municipal Council.

Public Buildings, Churches and Schools

Burdett, Alta.
Tenders are now being received by the secretary, F. A. Lumbard, for the erection of a $20,000 school for the Burdett Consolidated School District.

Coaldale, Alta.
Tenders are in and contracts will be awarded shortly for the erection of a school for the Ready Made Consolidated School District No. 46. Secretary, H. P. O. Ber.

Crawford Bay, B.C.
Tenders are being received by the Minister of Public Works until noon, July 16, for the erection of school and outbuildings for the Department of Education, Parliament Bldgs., Victoria. Engineer, A. E. Foreman.

Dundas, Ont.
School board contemplates the erection of a school. Secretary, W. H. Moss.

Edmonton, Alta.
School Board will erect a $10,737 school. Secretary, W. Bradey, Civic Blk.

Forestry, Alta.
Tenders are in and contracts will be awarded shortly for the erection of a school for the Forestry School Board. Secretary, A. F. Van Kley.

Halifax, N.S.
St. Mark's Church contemplate the erection of a church on Kay St. Pastor, Rev. N. E. Lemoine, Gottingen St.

Hamilton, Ont.
The Board of Education contemplate the erection of a public school on Murray Street. Secretary, R. H. Foster.

High Prairie, Alta.
Tenders are to be called shortly for the erection of Consolidated School for Prairie River S. D. No. 1833. Secretary, S. K. Read.

Kinmundy P.O., Alta.
Plans and specifications are with the secretary-treasurer, Colin T. Leich, who will receive tenders until noon, July 15, for the erection of a frame school for Thackery School District No. 3501.

Lethbridge, Alta.
Tenders are being received until July 22 for decorating and painting several schools for the School Board. Secretary-treasurer, John H. Flettwood.

Plans are in progress for $75,000 two-storey provincial police station for the Department of Public Works, Provincial Government. Minister, Hon. S. J. Latta.

Vancouver, B.C.
Tenders are being received by the secretary, Edward Cannell, until 5 p.m., July 15, for general trades, including plumbing and heating, for $60,000 tuberculosis clinic for the Rotary Club of Vancouver, Hotel Vancouver. Plans and specifications with the architect, J. A. Benzie, 510 Hastings St. W.

Vegreville, Alta.
By-law will be submitted for the erection of a public library for the Town Council. Clerk, Miss M. G. Warren.

Vegreville, Alta.
By-law will be submitted for the erec-

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Stop Catering to Labor And Solve the Problem

THE labour trouble in Toronto between the city and its employees has been settled by the appointment of a board of arbitration of five members, two to be appointed by the city, two by the men, and a chairman to be chosen by the four members.

It is fortunate that the city was able to avert an extended strike of its employees at this time, and particularly so on account of the genral unrest among labor that a strike in any one section of it is almost certain to create. A general strike under present war conditions would be a very serious matter, which, apparently, the men realize and are not slow to take advantage of. That they realize in anything like the same proportion their obligation to the country in continuing war and other essential business, is not equally evident.

It is quite true that the men's argument that they are unable on the present scale of wages to live in the manner they would like to, is a reasonable one. However, it must be remembered that this is a condition under which a very large proportion of the population of our cities and towns are living at the present time. The evidences of luxury and extravagance that one sees on the streets represent a very small percentage of our populations. Also the number of firms that can justly be accused of profiteering, while doubtless such do exist, is nevertheless very small. These are facts that the labor man probably does not take into consideration. When he strikes he has it in mind that he is taking his extra wage from the pockets of the wealthy and the extravagant, when, as a matter of fact, much the larger percentage of it comes from the sparse incomes of a class of people no better off than himself and in a much less favorable position to hold the pistol to their employers and whose employers, indeed, are in no position to recognize claims for increased remuneration, however just and reasonable these may be.

It is just possible that the board of arbitration will not find in favor of the men, but, in general, it may be looked upon that the men have won their case. A board of arbitration, composed as this board is, is practically a one-man tribunal. The city's representatives may naturally be expected to oppose an increase, the men's representatives will be equally eager to exact the last drop of blood. The decision thus rests with the chairman. If it happens in the present case, as is so often the case, that a chairman cannot be agreed upon by the four members already appointed and the government is asked to name him, it may almost be taken for granted, at least if one is guided by precedent, that such appointment will be favorable to the men's cause.

We are of the opinion that the Dominion Government at the present time should exercise power to make strikes impossible, at least while the war is in progress. They have gone so far as to say that everybody shall be employed in some useful occupation, and surely it is the height of extravagance for useful man power to be walking the streets at a time when their products are so urgently needed, to say nothing of the tremendous inconvenience that inevitably results to every other branch of trade when one cog in the wheel refuses to do its part.

Doubtless the majority of people are looking forward to the time when the war will be over and labor will be more plentiful and the present unbearable conditions relieve themselves, but in the meantime it seems to be the tendency on the part of our governments and of the daily press to cater to the laboring element. It is an unhealthy condition, and we do not believe the labor situation can ever be solved until those in authority have sufficient backbone to disregard the possibilities of the antagonism of the labor element at election time.

Care in Design Greatly Enhances Architectural Features of Bridges

FREQUENTLY bridges and other structures do not fit in well with the landscape, due either to a misunderstanding of the nature of the details which add artistic beauty to the structure or to a neglect of these details. Few municipal officials are interested in artistic features which they believe can only be obtained at a considerable extra expense. If a bridge stands up well under traffic and resists shifting in times of high water, it has no doubt given service for which it was designed. While the subject of artistic treatment is really not a rigid requirement, yet it is surprising what can be done to make a bridge or a building form a part of the landscape.

It seems to be the general opinion that a piece of construction can only be made artistic by certain "added on" treatment to the structural members, in the form of fancy hand-rail scrolls, lighting fixtures, etc. However, there is a possibility of adding greatly to the pleasing lines of a bridge by carefully considering the type which will best suit the surrounding conditions, not only as regards the loads to be carried and the most economical type of truss, but also that which will conform best with the symmetrical lines and the individuality of the surrounding landscape. For comparison we will consider our streets in residential districts.

In order to beautify the section under consideration, we frequently insert curves, avoiding right-angled corners as much as possible. Should not this effect be carried farther? There can be little doubt that this curve feature (although it is one which the engineer generally tries to avoid because of the increased amount of calculation required) forms an important part in making a bridge an interesting component in the landscape, especially if the roads in the immediate vicinity contain many curves. On a straight road the curved member may not fit in so admirably, but the ordinary pony truss, for example, may suit the conditions much better both as regards economy and symmetry.

In studying the photographs of well-known bridges, how often we see where the bridge is open to criticism as being too squat or too high, having too many spans of unequal dimension, having evident misplacement of certain structural outlines and so on. There are evidently certain governing features about a structure which determine whether it is going to present a handsome appearance or merely serve as an aid in transportation.

A steel bridge, to the ordinary layman, seems to convey an impression of great skill and perfection in workmanship, as well as a structure which will stand up under all conditions and be capable of a considerable amount of elasticity; in this class of bridge there is a wide scope for the development of architectural attractiveness by varying the style and shape of the structural members and carefully placing the spans.

In regard to the reinforced concrete structure, we have a type which conveys a somewhat different impression to the mind of the man on the road. The inner construction is not open to the eye and the massiveness of the construction gives the bridge a somewhat stolid and inelastic appearance, and yet it conveys to the mind a pleasing outline and one which is a credit to its designers. In the concrete bridge there is also a wide field for development in architectural features. This was well shown in the successful treatment of the reinforced concrete arch bridge designed by Mr. Barber, spanning the Humber River, recently described in the Contract Record.

There is little doubt that each bridge or building could have its special adaptation to its particular location and that architectural features may be contained in the bridge at such a small increased cost, if any, that they would warrant consideration by municipal and public officials. Then again we have to consider features concerning the bridge site. Generally, for example, it is desirable to carry the natural grade of the road over the bridge floor. If this is not possible owing to high water conditions which require increased floor height above mean water level, the approaches should be eased off to make the change of grade as gradual as possible.

Cracked and poorly surfaced abutments are a frequent source of unsightly appearance, especially where the coarse aggregate of the mixture is visible at the surface, and the shape of the piers and wing walls has much to do with bringing out the architectural features of the structure, especially where the approaching roads are so curved that a side view of the structure is presented to the travelling public.

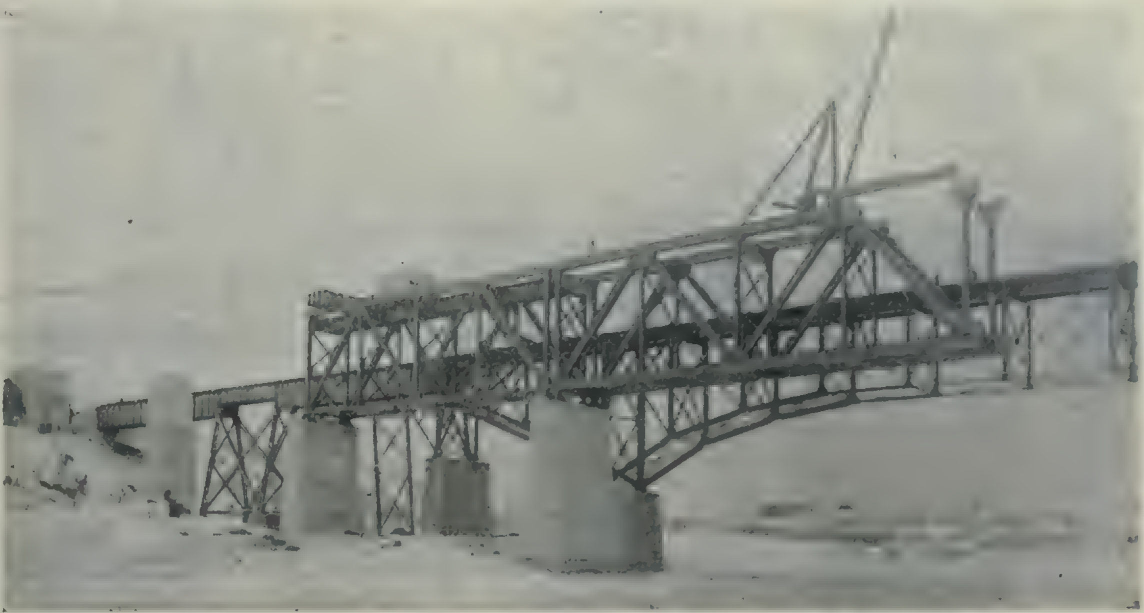
Is a Concrete Pavement or Road Surface an Arch Bridge?

WHILE an arch principle, when referred to in civil engineering work, generally is connected with some part of a building or bridge, the fact that all our pavements are arches probably has not been duly considered. On a road, for instance, the rise of the crown is governed mainly by the nature of the subgrade soil, the width of the road bed and class of pavement to be laid, while on the other hand, the rise of an arch bridge depends to a large extent on the span and the direction in which the resulting stress will be transmitted to the abutments and, finally, the surrounding soil.

Probably the main difference between the arch principle in the bridge and in the road surface is that in the first instance the pressure is transmitted to individual abutments, while in the case of a road surface the sub-soil acts as a continuous abutment. As to how arch action would tend to make a pavement more stable under heavy traffic travelling at high speeds is a matter open for discussion. It may be that failures in a pavement are often caused by the inability of the arch to sustain loads when certain portions of the sub-soil have become disintegrated. Althought this principle of arch action in road construction is worthy of consideration, it does not seem practicable at present to apply methods of arch bridge design to the pavement because of the more or less unstable condition of the pavement's so called continuous abutment.

Acute Housing Situation is General

Sault Ste. Marie, Ont., like a great many other towns and cities throughout the Dominion, is faced with an acute housing problem. Sir William Hearst recently attended a meeting there, at which the situation was discussed. The question of changing the Ontario Housing Act to meet present conditions was brought up and the Premier assured the gathering that there would be no difficulty in having any legislation passed which would help to solve the problem, either for communities or the province as a whole. He had no policy or plan to announce, however, as none had been formed. Referring to the committee which had been appointed in Toronto to deal with the subject, the Premier said that he wanted to obtain all possible information and would report to that committee. He also enquired as to whether there was a demand for houses on the instalment plan, and mentioned exemption from taxation as a possible means of encouraging building. After some discussion, in which no definite conclusions were reached, Sir William suggested that a committee be appointed to handle the matter and collect all information possible, to be forwarded to him at Toronto and placed before the committee there.



Placing the centre section of top chord of the channel span—C.N.R. bridge, Grand Mere, Que.

New Bridge on the C.N.R. over St. Maurice River at Grand Mere

By Mr. H. M. White*

A NEW bridge, replacing the old cantilever, has just been completed on the Canadian Northern Railway, Eastern Lines, over the St. Maurice River, about one mile east of Grand Mere, P.Q. The bridge, as seen in the plan, Fig. II., consists of two 100 foot deck plate girder spans, two 115 foot deck truss spans, one 250 foot deck truss span and one 38 foot deck plate girder span. The old cantilever bridge, shown as Fig. I, was built by the Dominion Bridge Co. Ltd., in 1895, and was flanked on the western side by a 100 foot deck lattice span, the remaining portions of the depression being served by wooden trestles. In 1910 the western wooden trestle was burned and the lattice span wrecked by a train, the bracing of the west anchor arm of the cantilever being at the same time slightly damaged. To take the place of the destroyed trestle and lattice span a steel trestle consisting of two bents and three deck plate girder spans was constructed by the Dominion Bridge Co. In 1915 the sway and stringer bracing of the main cantilever were reinforced and in this condition the old structure served to carry the traffic until the present summer.

In order to reduce the excessive grade at this point the track has been raised fifteen feet, which makes the distance from base of rail to ground line for the intermediate piers about 70 feet and in order to minimize the height of the piers the trusses were made deeper than would otherwise have been necessary. The truss spans only are new this year, the eight-year-old girders from the trestle mentioned above being used on new piers. The side truss span has four panels at 28 ft. 1½ in. and is 35 ft.—9½ in. deep, while the channel span has eight panels at 30 ft.-9 in. and is 36 feet deep to the centre of gravity of chords. The chords and diagonals of the trusses are built up box sections while the posts are I sections, composed of a web plate and four angles. The pier members are steel castings with pin bearing between truss and shoes. There are the usual two lines of plate girder stringers, heading into the floorbeams.

The piers being about 50 feet high and the river here very deep, erection by the cantilever method was naturally adopted. The erection stresses were nowhere large enough to affect the sections of the truss members so that no extra metal was necessitated by erecting in this manner. The west truss span was erected first. A timber bent was built at the centre of this span and the truss was assembled by means of a Bay City derrick car working from the old bridge. A 12-ton stiffleg derrick, shown in the photograph, was then set up on the span on trucks which ran on the top chords and with this derrick the west half of the channel span was erected, cantilevering out from pier 3. The 115 ft. span was used as an anchor arm and additional counterweight over and above the weight of the steel was secured by anchoring the "free" end of this truss span to pier 4, using, for this purpose, two 2 in. dia. bolts 17 ft. 2 in. long, at each corner. The east half of the bridge was then erected in precisely the same manner.

The cantilever portion was connected to the anchor span of the top chords by four 12 in. x 1 in. plate links on 5 in. dia. pins, and at the bottom chords were held apart by cast steel rocker blocks. These links were made 4¼ inches short of the normal length in order that the ends of the cantilevers at the centre of the channel would be elevated above normal to facilitate making the centre connection. The expansion pier members were arranged to accommodate the expansion of the bottom chords during the change from the cantilever to the simple span conditions. To permit of a final adjustment in case the chords did not meet at the centre of the channel span, both

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[*] Dominion Bridge Co., Montreal.

pier members on pier 3 were on rollers on which the west half, both cantilever and anchor span, could be moved a few inches forward or backward as might be necessary. However, no such adjustment was necessary as when the last section of bottom chord was lowered into place it fitted perfectly and the bolts connecting it to the centre bottom lateral plate were put in place without difficulty. The anchorages were then gradually loosened allowing the middle of the channel span to descend and as the holes in the gusset plate came to a match with those in the web of the bottom chord the bolts were entered, and, the span being lowered still more, the diagonal connection and top chord splices were bolted. As soon as the top chords touched at the centre, the loosening of the anchorage was stopped and the span was left partially suspended until all the splice rivets were driven in the bottom chord. This method insured tight joints in the bottom chord splices and secured a very satisfactory camber. The ends of the anchor spans were then jacked up and the erection links removed. The top chords, being now in compression, were riveted under the best possible condition. All the end bottom struts were designed to permit of jacking so that the pier members may be repaired or renewed at any time. The deck steel was put in the anchor spans as they were erected but the stringers and stringer bracing of the channel span were omitted until the anchor spans were jacked up and the cantilever condition removed, thereby minimizing the erection stresses. In the meantime these stringers were placed on the ends of the anchor spans, giving additional counterweight as it was considered advisable to keep the strain on the erection anchors in the concrete piers as low as possible.

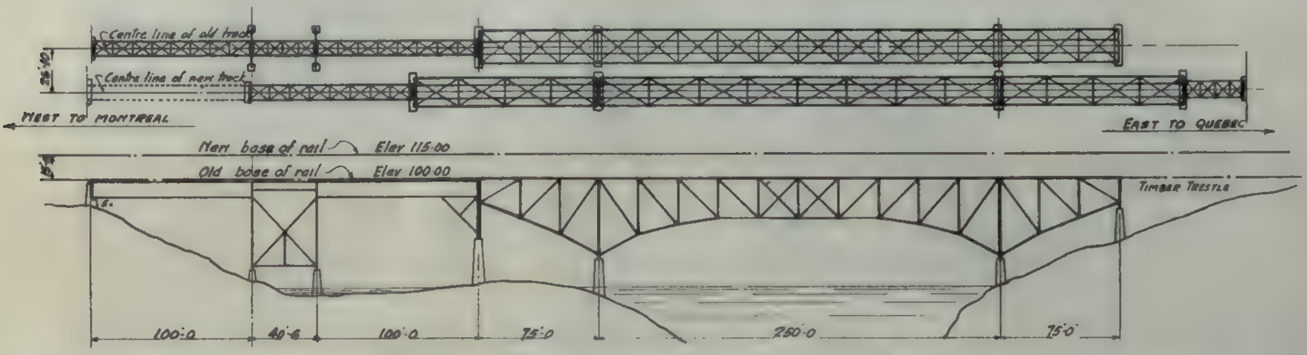


FIG I ELEVATION OF OLD BRIDGE

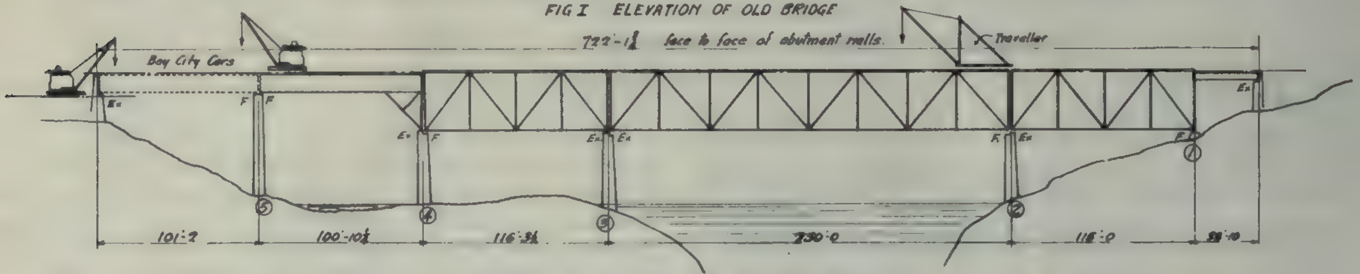


FIG. II ELEVATION OF NEW BRIDGE.

Canadian Northern railway crossing over St. Maurice River at Grand Mere, Que.—Built by Dominion Bridge Co.

After the trusses were completed the 40 ft. deck plate girder span was removed from the trestle posts, fitted with new pier members and placed in position at the east end of the bridge. Traffic was carried across the opening thus created in the old structure by three beam spans supported on a timber tower, which was built before the girders were removed. Moving the two 100 ft. girder spans was accomplished on Sunday, April 14th, trains being run over the old bridge on Saturday and over the new one on Monday. These spans being too heavy to be handled as a whole were cut apart and the separate grinders moved by means of two 30 ton Bay City derrick cars, which have a capacity of 16 tons at 25 feet radius. One car worked on the west end of the old bridge and the other on the new truss spans. The girders weighed 31 tons each and special care had to be taken in hitching to these so that the cars would not be overloaded. The first steel was erected on Feb. 1st, the channel span was connected at the centre on April 2nd and riveting of the trusses was completed about June 3rd. The steel on the two 115 ft. trusses weighed 616,650 lbs., in the 250 foot span 936,000 lbs., and the total steel in the structure, including girder spans, about 1,890,000 lbs. The superstructure was designed and built by the Dominion Bridge Company, Montreal, Que., the writer having special charge of the design and the development of the erection scheme. The whole work was subject to the approval of Mr. W. P. Chapman, engineer of bridges, C.N.Ry., and Mr. C. H. Connell, engineer of Quebec Division C.N.Ry.

The plans prepared for the proposed military depot at North Rosedale, Toronto, call for the erection of ten two-storey bunk houses, each of which will accommodate 200 men. They will be built of wood and plaster and located close to Sight Hill Drive. In addition to these there will be a kitchen in a separate building, officers' quarters and administration building, store house, guard house, dining hall and recreation hall. With the exception of a small portion, which will be given over to the administration, the entire St. Andrew's College building will be utilized for beds. Final plans for the whole undertaking are not yet confirmed, but are being rushed.

It is proposed to change the present system of management of waterworks department in Toronto, by separating the financial end from the works and property, placing the former under the jurisdiction of the board of control, and the latter under the committee of works. The finance commissioner and the commissioner of works will thus be the respective heads.

The Place of the Architect in the Field of Construction

THE American Institute of Architects has decided that, in future, it shall not be considered unethical for its members to advertise. It is, we believe, a good sign—a sign that the value of the architect's services; like the value of any other merchantable commodity, is going to be judged, more equitably, by the evidence he can put forward regarding its actual existence.

We think no one will argue that the average architect exerts that influence in the field of construction that is, in general, expected of him, and that, indeed, he usually assumes. Either it is the case that the average builder expects too much of his architect or the architect falls short of his duty, for it is a regrettable fact that more disagreements arise between the owner and architect than between any other two parties to any agreement that is made in the ordinary way of modern business. The owner expects practical assistance—the architect sells only architecture. He has no practical training or inclination or interest or, if by chance he has any or all of these, he considers it unethical to exercise them.

Perhaps, after all, the biggest trouble lies in the attitude of the architect towards his work. Contrast with it the attitude of a medical practitioner towards his patient. He is not merely interested in the effect of his medicines; that is an incidental. But he does concentrate all his knowledge, experience and personality to return that patient to perfect health. Whatever is at fault in the patient's anatomy is attended to. Now isn't that about what we have a right to expect of an architect in reference to a building he undertakes to erect for us? He agrees to plan and supervise. Doesn't that imply attention to all the ills until such time as the building is turned out a perfect structure?

When the architect actually fulfills this function in the building world, he will be an all-important factor. Until such time as he does, there is ample excuse for the many instances where he is entirely ignored. Quite a good article, perhaps not entirely in support of this view, but anyway in favor of the architect getting rid of his "negative" attitude and playing a more forceful part in the building campaign which must be promoted to meet conditions both immediately present and future, is written by Mr. C. H. Blackall in the American Architect. He says there are two distinctly varying concepts of an architect. The first is that he is an artist, that his chief interest is in making pictures, either on paper or in actual composition; that business has nothing to do with him except as an incident to his art; that, as architecture is the mother art, therefore the architect is at his best when occupying himself most exclusively with the pure art of his profession. This view does not preclude a recognition of business, construction and other so-called practical factors, but it puts the emphasis on the creative and artistic, relegating everything else to a second place. This is the view which has gradually been gaining since the beginning of the Italian Renaissance, and which has dominated the profession during the past few years, shaping its ethics, controlling its practice, and, in as far as it is one sided, limiting the effective output of the individual. The other view is expressed by the very word "architect." He is not the "builder of arches" but the "arch technician," or, to use the modern phrase, the master builder. His function is to do and plan things in an orderly sequence and with a consideration for all the factors which enter into a complete structure, of which, very naturally, the artistic appearance may be beyond question an important one, but is not of itself sufficient, and, except in rare cases of monumental design, is really a byproduct rather than a dominant factor. He differs from the engineer in that he is not to be one-sided, not to consider mere efficiency nor mere program, nor mere so-called practical factors, but is to take all of these plus the fundamental principles of order, purpose and fitness; and if they are properly combined then the creative element of pure design will result just as inevitably as it did in the west front of Amiens or the north porch of Chartres.

This second concept was the point of view of the thirteenth century, and if the signs of the times are read aright it is the attitude that the architect will be forced to assume, even against his will at times, and even if under imputation by some of his professional brethren of being unprofessional. The absence of this attitude or the negation thereof, is sure to bring paralysis to the profession, because the busy public, which pays the bills, has scant use today for anything but action. The war has emphasized this view with sharp and, to many, sickening vividness. It is not enough to be a clever designer, or even the best designer, if best is used in the sense of permitting a disregard of functional building. Rather should we say that absolutely nothing be sacrificed to mere appearance. Artistic appearance, so-called, can, and justly will, be forgotten and be apparent only through its function as an integral part of a real problem solved in a real way. That was precisely the fundamental point of view of the mediaeval artists. Their work was always objective; self was always put out of sight, and as we emerge into the opportunities of tomorrow it is our task to make sure of our point of view, and not only make sure of it but incorporate it in our work. The architect may continue to dream dreams and see visions, but if he does he is likely to be out of a job unless those visions are based on sound common sense, on business administration and on constructive development and application.

Contractor, Engineer or Architect?

There will always be building so long as mankind is a gregarious animal. There will also always be a consideration given to the finer artistic qualities which the race incorporates in its monuments and which constitute the true historical record of the age. The question we are interested in as a profession is as to who is to be the directing force in this building work. Will it be the master builders, as they are known? Will it be the engineers, whose day is shining so full of promise now, or will the choice be from the profession which has striven and aspired, written codes of ethics, and taken position on pedestals, beneficiently arrogating prominence in constructive arts, and speaking ex cathedra on every occasion, only to find that consideration is no longer an inevitable appanage? It is really a pretty serious question for us. No man is likely to have the whole truth revealed to him, and none of his reasoning from finite experience and limited vision can hope to answer all of the question; and yet it hardly seems possible that the architect of four years ago will have much consideration four years hence, unless he changes very fundamentally. He must be a new man, regenerated by the acid test of trouble, and with a point of view toward real architecture more nearly akin to the mediaeval period. It is the writer's conviction that the architect of tomorrow will find his truest inspirations in the mediaeval attitude rather than in that of the Renaissance; that whether we admit it or not, whether we like it or not, whether we are chosen or not, the architect of tomorrow must be not first an artist but first an organizer and an administrator. That the older members of the profession will change, is, of course, very much to be doubted; that many mistakes will be made goes without saying; that the unworthy and the unfit will be just as prominent then as they are now is too manifest to need discussion. But that the architecture of after the war will be something real and something earnest, not obscured but thoroughly concrete, and that the architect will then be the one who can lead in just such lines, whether he comes from technical schools, from the engineering ranks, or from the master builders, is something which I firmly believe, and to which all the signs of the times seem to point.

The Architect of Tomorrow

At the risk of repeating, let me say what I think the architect of tomorrow will be.

In the first place, he will be an organization rather than an individual; a directing, discriminating motive force at the centre of a combination of forces, and that organization or combination will be just as essentially a business one as the United States Steel Corporation or the Standard Oil Co., and exactly the same principles of economy, material efficiency and careful attention to detail will of necessity manifest themselves. This organization will be prepared not only to carry out work on definite lines, but to pledge itself that they will be carried out right and on time. In other words, it will guarantee results, and not be able to avoid responsibility by sheltering itself behind a cloak of professionalism. I do not believe that it will assume all the functions that we now hand over to the master builder, any more than I believe the master builder will lose materially in his particular line, but it will have a greater degree of direct contact with the mechanics, many times, I believe, a direct hiring of them on behalf of the owner and a general direction of the work which is now very often in the hands of brokers styling themselves master builders. And the fact that this organization is to free itself from mere professionalism and abandon the cloister or studio point of view, will necessarily bring it into the world's markets so that it will have direct contact with the producing factors that enter into a building. It may even direct these producing factors and be a part itself of the producing side; and still further, as all large works have to be financed, I see no reason to doubt that the architect will have a considerable importance as an administrator, and therefore necessarily, to a certain extent, as a financial agent.

Furthermore, this organization will be formed not to win a competition or to impress a susceptible public, but to carry out building. The kind of organization that will win a competition is pure theory, and pure theory is what we must avoid. The organic development of building, if looked at right, is pure architecture, and that is just what the world wants. It is to be hoped that the future may see a larger abolition of that unfortunate method of bringing ourselves before the public which we call competition. The true competition always is in the finished product, but the idea that by a series of drawings an architect can win recognition is, I believe, at the basis of a good deal of our present limitation as a profession; and the more resolutely we in the future refuse to consider architecture as in any sense drawing, as in any sense picture making, the more surely will we emerge into the larger view which the coming years are to demand and to which we have been so blind in the past. There are many who have had their eyes opened to the extent to which we have not as a profession properly viewed our limitations, and we will have further disagreeable experiences, I am afraid, before the true architectural point of view is brought home to us. We are still passing through the mill, and compensation for our present woes ought to be, in part at least, in the feeling that out of defeat can and will grow a better equipment for victory.

Utility First, Art Incidental

Does this imply architecture will be any less a fine art than it is today? Not a bit of it. The trouble with so much of our pre-war architecture was not that it was too artistic, but it was not artistic in the right sense, in that it was not fit and appropriate for its purpose. Ruskin's emotional stone carver who, just for the love of carving, would cut a wondrous bit of detail way up in an obscure loft, where no one would ever see it, could keep on doing just that sort of thing sometimes, but he would not be in the architectural spirit. The place for that kind of work is in a museum and not in a real building. Architects are to build real buildings, and the man who would waste that kind of sentiment would be out of place in the very practical, very tense and very demanding world of after the war. The best art always has been the art which was the most real in its application. Architecture would still be the mother art, but the architect, while admitting the pre-eminence of the artistic thought, would I should hope, recognize also that art is not pre-eminent or maternal which is simply blossoming for itself without a distinct purpose, and the architect who thinks for a moment that the contemplative, aesthetic point of view, delightful as it is, necessary in a certain degree as it has been found to be, will suffice for after-war conditions, is bound to receive a harder jolt and a more bitter disappointment than in these parlous days of 1918. To paraphrase the poet, architecture is real, architecture is earnest, and mere unrelated beauty is not its goal. A dream of pure art, a dream of beauty cannot be spoken of the real soul of a building.

Nor does the foregoing imply the elimination of the individual. There have been some wonderfully endowed men like Wren, Mansard or Bulfinch, who seemed to be able to compass all sides of our profession and to properly subordinate the relative factors; but, after all, most of us work best in harness and with limitations, and the very fact that an organization implies subordination of one part to the other is a salutary restraint on the development of the unessential. Again, a man might be just as strong and true alone by himself as he would be as an individual doing similar things at the head of an organization, but somehow I cannot help feeling that the individual architect will be much more of a rarity in the future than he has been in the past, and that in organization, in co-operation and specializing within the limits of a firm the architects will find their best opportunities.

After the war this country will undoubtedly pass through a period of enormous building activity. We have slowed up on all our lines; we are behind in every kind of structure having to do with the arts of peace; our investments in real estate have had a great setback, and for certainly three or four years after the war there will be a lot of big prizes to be passed out to some one. Who will get these prizes? Will it be those who want them most or those who can do them best? The answer is so obvious that it hardly needs argument. The great mass of our people do not know and do not care whether a building is artistic or not, especially as far as relates to the selection of an architect, but the great mass of our people, on the other hand, are pretty good judges of what they like, and unless we are prepared as a profession to give them a square deal, a business administration and a workable solution of the so-called practical requirements, and unless, furthermore, we can do all that, and, besides, clothe our expression in real art—and by real art I mean art that is fitting and proper, neither overlaid, considered apart, nor obtruded—we simply will not get the work, and the sooner we admit it and shape our plans accordingly the more likely we are to be of real service to the community for the next ten years.

Public the Final Judge

I believe the profession will justify itself to the world, and justify itself in a way to bring absolute conviction to the public, whose attention has really never been caught by mere pretty work. The thought and study, the intense preparation, the carefully considered educational scheme which has been so thoroughly developed in the past, cannot fail to count in the long run for the very best side of real, practical, common-sense architecture. It is, of course, much easier to make these general statements than it is to say just how the results will be manifested. I sometimes wonder if a good deal of our troubles in the past and in to-day have not arisen from the fact that we have allowed the general public to believe that a diploma of architecture, or sometimes even a sign on a door, is an indication of ability, and whether we have not been a little ready to assume that an architect can be such by mere willing to be; that the will to win will create a good architect, according to our imagination, just as some military critics think the will to win insures the winning of the war; and it is quite possible that certain portions of the public have accepted us at our face value and assumed, because we called ourselves architects, that therefore we be such. I sincerely hope the war and our present experience may brush this idea absolutely aside. Temperament, natural endowment and birthright certainly count for as much in the practical business side of architecture as they do in the dream life of the imaginative designer, and the number of those who are really able to handle the architectural problem is, after all, surprisingly small. The public will appreciate this better after the war, and the architect who has the gift not to make pictures but to make architecture will undoubtedly have ample opportunity, and with a clearer field and a more sure appreciation if he can deliver the goods; but may the profession be delivered for generations to come from the attitude that the architect can create himself, that a four years' course in a school can make amends for a wrong temperament, or that even the fathering of a lot of poorly designed buildings gives a man the right to call himself an architect.

The architectural profession will profit by the experience of the war, Mr. Blackall concluded. A future opens up for it bigger than anything we dreamed of before, because our buildings will be real buildings instead of fancies, our business will be real business instead of that of dilettanti, and there is enough real common sense in the profession to enable even some of the older ones to grow into administrative ability; while as for the young men who will be coming home from the wars, eager and ready to take their share, and fresh from the influences of the delightful atmosphere in France, they surely will be doing real things, just as they are doing real things now; and the biggest thing on earth will then be, as we have fondly assumed it had been in the past, a great work of architecture.

Tackling the Housing Problem

The Ontario Housing Committee is bending its energies towards the working out of a solution of the housing problem in the province. There was a full attendance of the members at a recent meeting held in the committee's offices in the Royal Bank Building, and the housing conditions throughout Ontario were fully discussed. It is realized that in many communities, where immediate provision of housing accommodation is necessary, exceptional measures are required to meet the situation. Mr. C. B. Sissons, secretary of the committee, stated that "while the committee feels that it must not come to any rash conclusion, it is endeavoring to learn what are the obligations of municipalities of the province, of manufacturers, and what steps can best be taken to ensure a good class of houses being built, and to enable workmen to purchase their homes on easy terms of credit. The committee also recognizes the need for an early dealing with this problem." The secretary has drawn up a circular letter which is being sent to mayors of the towns and cities of Ontario, in which the following questions are asked:

(1) To what extent is there a housing problem in your city?

(2) Upon what body, if any, other than private individuals, lies the responsibility of meeting the present shortage of houses? Please state reasons for your opinion.

(3) In your opinion can private enterprise be depended on to meet the existing demand?

(4) What practical steps, if any, have employers in your city taken to meet the need of housing accommodation for their employees?

(5) Has building been undertaken by the municipality or co-operative societies?

(6) In such enterprises, individual and collective, have town-planning, architectural appearances and public health been considered

(7) Are you disposed to favor the partial or total exemption from taxation of workmen's houses for a period of years, in order to stimulate building?

(8) What further suggestions, if any, have you to make to meet the particular requirements of your district?

It is explained that in the public interest the fullest possible information should be advanced to the committee with respect to housing conditions in cities and towns, as well as rural districts, that a permanent policy may be reached.

A Standard System for Recording Motor Truck Costs

IN order that the contractor may operate his motor trucks at a figure which will justify their use, on the small contracts especially, he should have some idea as to the cost of operation from day to day. The difficulty in gathering data seems to be in reference to the proper method of keeping costs. Scarcely any two truck owners figure their costs in the same manner, regardless of the fact that they are both in the same business and use the same class of truck.

In computing depreciation for instance, a specified sum is set aside each year without regard to the fact that the rate of depreciation is not uniform, but increases with the age of the truck. Again tire maintenance may be charged for only when each tire is entirely renewed, instead of distributing the charges as the tire wears out. The need for some standardized system is duly expressed in the following article by Mr. S. V. Norton, manager truck tire sales of the B. F. Goodrich Co.:

A large number of truck operators are either not making or not saving the money they should from their trucks. Many of them are actually losing money. Why is this? Simply because truck owners have been too busy delivering their goods to ask them selves, first, "what does it actually cost me," and second, "what ought it to cost?"

The first essential is to know the cost, for without this knowledge the delivery system may unwittingly be run at a loss. Having the exact information as to what it costs, the truck operator may, by study and comparison with other systems, satisfy himself as to what it ought to cost, and either economize by improving his methods, or charge his business or his customers more, if he finds it necessary, as a matter of sound business policy.

Difficulty of Devising a Standard System.

Any individual cost keeping system, however well designed, cannot serve the motor truck industry adequately so long as several other cost systems, which may also be well designed, are in existence. The difficulty comes from a lack of uniformity in the treatment of various items of expense. Truck owners who use systems which have ben compiled by authorities on motor truck accounting or by general expert accountants, and which are generally complete, show results which are not subject to comparison because of varying methods of computing identical items. For the doctors have not agreed as to the proper way of figuring certain motor truck costs. There are, for instance, at least four methods of figuring depreciation, each one of which has its champions among those held to be experts in the field of accounting.

Two truck operators, "A" and "B," use systems devised by competent accountants. These systems are complete, in the sense that they include every item properly chargeable to truck operation. Consider the item of depreciation. A's cost system provides that depreciation shall be figured at 20 per cent a year, charging off the entire cost of the truck in 5 years. But B's cost system declares that depreciation must be figured on a mileage basis, allotting 80,000 miles as the expected life of the truck. Both operators use cost systems designed by experts, yet the difference in computing this one item alone may amount to $100 or $200 a year!

Take the item of maintenance (which includes repairs). Charges for maintenance are unique in that they generally fall heavily on certain months or even years, while many months or even a whole year may be clear of them. Suppose a man operates a truck for a whole year without any considerable expense for repairs, but at the beginning of the following year finds it necessary to have his truck overhauled, at a cost of $500. It would be obviously wrong to let the first year go free of this maintenance charge, especially since nearly all the damage was done in that year, for which the bill was not rendered, so to speak, until the following year.

But there is a third possibility. As the truck ages, the charge for maintenance increases year by year. Should this charge be estimated at an average for each year, or should the actual expense be taken as it occurs each year? Thus we have three possible ways of figuring maintenance charges, each one of which is featured in some cost system which may be found already in print.

Various Ways of Figuring Cost.

The cost of tires may be computed in several ways by those who follow the guidance of various cost forms as well as those who devise their own systems. Tire expense is going on every minute the truck is in operation, but the purchase of tires may occur at intervals separated by a year, or in some cases even two years. It is inaccurate, of course, to charge expense of tires against the month in which they are bought, or even the year, if those tires are also used in a part of the previous or the following year. The logical way of handling this item is to distribute the expense over every day the tires are in service. But here again, two possibilities present themselves. Inasmuch as it is not known at the time the charge is entered, how long the tires will last, shall the charge be estimated on the basis of the tire maker's guarantee, or shall an attempt be made to estimate (from past experience), the probable life of the tires? According as one or other of these plans is adopted, different results will be obtained.

Interest is an item which different accountants figure in different ways. There are at least half a dozen formulas in print, each one well vouched for, and each one describing a different way of computing interest. Which is the right method? Which should be made standard?

Unit-cost is another item upon which experts disagree. Motor truck performance or work is generally referred to in terms of ton-miles; but package miles or thousands-feet miles are often used, according to the commodity carried. These different units are basically the same, being variations of the ton-mile, which is the standard unit.

Now the ton-mile, defined simply, is one ton of load hauled one mile. Easy to calculate, you say. But there are certain conditions of hauling which make it difficult to apply this simple formula. Thus, if a truck makes three or four deliveries on one trip, its tonnage and hence its ton-mileage is reduced. Again, if a truck picks up a load, or part of a load, on a return trip, should this be reckoned as a delivery or not? These conditions have given rise to various formulas for figuring ton-mileage, all of which give different results. As a consequence, although the cost of truck operation per day, month, or year, may be figured in the same manner for two or more trucks, when an attempt is made to compare the cost-per-unit-work it is discovered that different truck operators are in fact speaking different languages, and that a comparison cannot be made.

Features a Standard System.

From the foregoing it is obvious that almost any well-conceived standard system of motor truck cost accounting would benefit the entire industry, even though its rulings on some minor points might be open to debate. Take once more the item of depreciation, which may be computed in at least four differnt ways. Suppose a standard system selected as a way of computing this item, a method which there might be some debate: if all or even the great majority of truck owners began to figure depreciation according to the standard formula an enormous gain would be accomplished, for a common denominator would be established by which one truck could be compared with a thousand trucks in respect to this item. Suppose that certain inaccuracies were found to exist in the standard method; they would be the same for all participants and allowances could be easily made for them.

A standard system establishing a uniform method of figuring all the basic items of cost and performance, would provide a common language by which the experiences of all the truck operators in the country could be related and understood. It would unlock a great store-house of information, which is at present closed to the average truck owner. Whether its methods were correct in every detail or not, it would provide the common measure by which every installation could be judged. This must always be the supreme function of a standard cost system.

Here are some of the facts which any well-conceived motor truck cost system should reveal:

Number of trips; customers or deliveries; total loads in units; average load in units; miles travelled; round trip distance; unit——miles; miles per gallon of gasoline; miles per gallon of oil; standing time at plant in hours and minutes; running time in hours and minutes (including stops); average loading time per trip; average speed in miles per hour; estimated running time per mile; estimated time per customer's stop (in minutes); cost per day (at work); cost per mile; cost per unit; cost per unit mile.

Standard System Devised by Truck Owners' Conference.

What former attempts to establish a standard cost system have lacked, seems to be abundantly supplied in the movement originated by the Truck Owners' Conference, Inc., of Chicago. While the Truck Owners' Conference desired to attack the problem of a standard cost system without delay, they were compelled to give it their close attention from the beginning of the first meeting. The purpose of the conference was to get truck owners together and compare their individual problems with the idea of making the best methods of each available to all, and cost of operation with relation to work performed, seemed to be the one standard by which different truck installations could be compared. That is not to say that if two trucks of the same size and make are operated the same number of miles but at different expense, the truck having the lower expense should be judged therefore to be the more efficient, for conditions of service must be taken into consideration. But it was impossible to compare the efficiency of two or more installations until all conditions had been judged by a standard measure; that is, a standard system of costs. The Truck Owners' Conference, therefore, in addition to discussing various problems of motor transportation, set itself the task of devising a standard cost system. A committee was formed, not confined to a few experts, but having as well a considerable number of "practical" operators. Scores of cost systems already devised have been examined.

Distribution of the System.

First of all, no one will be permitted to make a profit from its sale. Bids will be asked for the printing of the standard form, and the work will be let to the lowest bidder. A price will be established covering the actual cost of printing. In view of the great number of copies which will be required, the price will probably be nominal. It is possible that electrotype plates will be made, and extra plates can be sent to different printers throughout the United States, if it is considered inadvisable to confine the work to one printer. The distribution will be made through many of those agencies—which are at present circulating cost systems of their own. These will include, notably, truck manufacturers and their agents, the makers, and magazines.

Although Montreal is in the middle of the building season there are few important works under construction or in contemplation, and with two exceptions, architects have comparatively little work in hand. Two additional munition factories and other factories of a smaller size are under construction, and plans for an extensive industrial plant on the Lachine Canal are being drawn. Work is also being carried out on a large church, the contract for another church will shortly be let, and plans for a third are in course of preparation. Two or three schools are being built. An institute, to cost about $100,000 is to be erected, and an apartment house, of the same value, is being built. Reports from the province show a fair amount of activity, a feature being the number of cottages to be erected for workmen by industrial companies. Bids have also been asked for a number of highway bridges, as a rule of small importance, but in the aggregate amounting to a large sum. Speaking generally, only work of the most urgent character is being undertaken, this including that at Shawinigan Falls, where construction is active owing to war demands.

Mr. Thomas Adams, of the Canadian Conservation Commission, Dr. Horace L. Brittain, director of the Bureau of Municipal Research, and Rev. Peter Bryce, are selected as judges of essays submitted for a $500 prize for the best solution of the housing problem in Canada, by the Ontario Housing Committee

Camp Sanitation

WAR conditions have brought about certain well defined methods of procedure in order to prevent pestilence where a number of men are housed in temporary structures. No doubt the large number of men in military camps has greatly increased the necessity for care in the method of disposing of dejecta, refusa, etc., but many useful lessons may be learned and results obtained which should be useful in preventing objectionable conditions where any number of men compose what is commonly known as a camp in time of peace. Although the nature of the district, as regards close proximity to residential sections, will govern to some extent the precautions which should be taken to prevent nuisance, yet no matter where a camp is located, there is necessity of guarding the health of the men themselves, by dispensing with old, objectionable customs and disease producing conditions. The following extracts from a paper presented by Mr. W. P. Mason, M.D., L.L.D., at the resent annual meeting of the Franklin Institute enunciates certain important features of camp sanitation. Relating to the advantage of placing dejecta as near the surface of the soil as possible. The following table shows the great difference in the numbers of ordinary bacteria found at sundry depths:

Immediately under the sod	114,000
1 foot below	47,800
2 feet below	39,000
3 feet below	9,500
4 feet below	6,700

Next to the dejecta is the importance of disposing of refuse, i.e., by the use of incinerators, many types of which are decidedly complex and expensive.

For a simple device, calculated to provide for a reasonable number of men, and especially suitable for garbage destruction, the Woodruff pit is worthy of attention. It is merely a circular hole in the ground, ten feet in diameter and about four feet deep, with the sides lined up with field stones. In the centre is a conical pile of the same stones to act as a sort of draft chimney. This pile can be advantageously supplemented by a couple of lengths of tile pipe or even old stove pipe. A good fire of wood having been started in this pit, a very considerable amount of camp refuse can be disposed of by judicious firing. Liquids should be slowly poured down the hot side stones so as to encourage rapid evaporation. If liquids be added in too great a bulk or thrown on too quickly they are likely to pass the fire zone and reach a lower level where they may start a nuisance.

One disadvantage of the Woodruff pit or of any other type of open fire is that when the wind is high light materials will often be blown about the camp; this is especially objectionable if the said materials chance to be what are known as "camp butter-flies" or toilet paper.

Urine can be well disposed of by the stone-filled soakage pits, adopted by the British Army, into which long funnels of wood or tin are extended. Fouling of the ground with consequent fly infection is thus avoided.

At one large New York camp a non-portable furnace was built which worked successfully. It consisted of three levels, of which the bottom one held the fire. The top level was a shelf extending from the front half-way or more toward the back wall, and upon this shelf was thrown the material to be destroyed. The middle level was also a shelf of about the size of the top one, but it extended from the back wall out toward the front. Thus the hot products of combustion followed a curved course under and over the materials on the two shelves. When the charge on the top shelf had become thoroughly dried it was pushed back so as to fall on the middle shelf, and when it had thoroughly charred in that position it was pulled forward and fell upon the fire.

A military furnace may be seen at Plattsburg which is operated without drying shelves. Its length is greater than its height, and the garbage charge is dumped directly upon the fire through a trap-door. The fuel is cord wood. Around the sides of the combustion chamber run iron water pipes that act like the water-back of a kitchen range and supply hot water with which to wash the cans in which the garbage is collected. The process is not continuous, and a new fire has to be started every morning.

While garbage is usually incinerated in a furnace such as this or in a Woodruff pit or in some still simpler arrangement burning either wood or coal, yet it generally contains so much combustible material that a device less costly in the matter of fuel consumption is to be preferred.

The Canadian camps, or at least some of them, are using a furnace, called the Reid incinerator, which is designed to operate continuously without any other fuel than that contained in the garbage itself after an initial fire of wood has been built as a starter.

In this type of apparatus a supporting grate-like set of bars is provided which suspends the garbage load and counteracts tendency to clogging. A further peculiarity of construction is a number of drawer-shaped draft holes which may be opened or closed at will, and which admit air to sundry well-spaced points throughout the body of the garbage charge.

The successful running of the Reid incinerator demands that enough garbage be supplied to keep the apparatus working on approximately full capacity.

Colonel Nasmith, of Toronto, advises the writer that while at the front in France excellent results were secured by constructing incinerator walls out of old oil cans filled with puddled clay. After a wall built in such a manner had been fired it proved very stable. Similiar cans used empty produced a reliable chimney and old railroad iron thrust irregularly through the furnace walls supplied supports for the garbage charge and permitted air to reach scattered points throughout the mass.

Doctor Nasmith found advantage to follow the introduction of old tin cans of every description into the furnace with the garbage, as thereby a desirable "porosity" was given to the material being burned.

Horse manure can be burned by arrangement such as just described, but the destruction of valuable fertilizing material savors of decided waste, and, moreover, a labor camp rarely contains enough horses to demand military measures.

Fifty horses will make about a wagonload of manure daily, but, however small the volme may be, provision must be made to prevent its becoming a breeding place for flies. Uusually, although not always, farmers are found willing to cart manure away for use upon their crops, in which case it is of interest to be certain that it is hauled to a sufficient distance before it is piled; otherwise, as a large camp presents many attractions for flies, the insects are likely to find it if the haul should be a short one. Major J. M. Phalan, U.S.A., believes that the only safe haul is one by railroad, for the reason that a distance likely to be covered by ordinary wagon hauling would probably prove much too short to prevent the flies reaching camp.

However much the average farmer may value good manure which is given to him, the labor camp is frequently so placed as to make the use of its horse droppings for fertilizer unprofitable because of the expense of removal. A small amount of manure can be made fly-proof" by a liberal wetting down with solution of copperas, but a much better treatment is that of destruction by fire. Windrows less than two feet high can be successfully burned if sprinkled with crude oil.

Before leaving the question of flies we should remember that a single insect can produce nearly a million descendants during a season. They feed to a large measure upon faeces, and their bodies and legs are covered with hairs, so that they can act as distributers of pathogenic organisms, by vomiting upon human food, by defecating over it, and by wiping their filthy feet upon it.

So much has been written upon the necessity of protection against flies and mosquitoes that it is simply needed here to insert a reminder that the development period, from egg to mature form, of each of these insects is practically the same; namely, about two weeks. Precautions in the way of thorough screening of quarters, removal or destruction of horse manure, and oiling or draining of water pools, however small, must be faithfully practised throughout the breeding season.

Peace Time Atrocities

WHILE we are all familiar with the atrocities which have been committed by the Hun, and for which we are all agreed there is no excuse whatever, certain atrocities have been committed in our very midst which could have been prevented—we refer to the undesirable living conditions which prevail in certain sections of very many cities in Canada. That the Empire is beginning to wake up to the facts is shown by the great preparations which are under way in Europe, and are surely coming to America, in the way of better housing and social conditions. The Municipal Research Bureau of the city of Philadelphia has recently isued a bulletin emphasizing this important matter:

Last year the secretary of the Canadian Red Cross told the convention of the National Municipal League of some sketches found on a German prisoner. One picture was of some houses in one of the worst of London's slums, the other was a degenerate Englishman. On the first picture was written in German: "If the British conquer, this is the kind of house that you will have to live in." On the other were these words: "This is the type of man that the British system produces." To what extent were these accusations true?

We have all shuddered at the tales of war atrocities. If we should take a walk through vast sections of Philadelphia, we should stand aghast before the "peace atrocities" that are continually being perpetrated by our social order. The misery, starvation, ignorance, over-crowding and immorality that exist in almost any of our large American cities are appalling.

It used to be the fashion to put the blame for such conditions upon the individual sufferer, but this is now passed. The sociologist, the economist, the social worker, no longer think in those terms. They frankly recognize that the ills of society are the fault of society and can only be socially cured. They proclaim that poverty, unemployment, and overcrowding are social diseases, exactly as preventable as tuberculosis or typhoid fever. Just as the installation of a proper water purification system greatly cuts down the typhoid death rate, so can well-conceived social measures do away with the diseases of society.

The trials of nearly four years of the world war have taught Europe lessons that America has yet to learn. Time has gone faster over there than here. If we could see ourselves as we are going to be, we must look at what England is to-day. The British Labor Party has produced a Reconstruction Manifesto which is being discussed the world over, as heralding the birth of a new social order. Steps are proposed which are intended to provide a national minimum, prevent unemployment, bring democracy into industry, nationalize the public utilities and natural resources, increase production, revolutionize national finance, introduce greater justice in distribution, and secure the national surplus for the common good.

It is not for us to uphold nor to denounce, but we must face facts as they are. These social problems are with us, and they must be solved. If we doubt the efficacy of a proposed remedy, it is up to us to suggest a better remedy. It is the greatest of mistakes to try to turn back the hands of the clock. The world is going ahead to solve these problems, and will not stop for the objections of a disgruntled few.

What has this to do with the Bureau of Municipal Research? Simply this: We shall do our little part in the betterment of society. Our field is Philadelphia and we find plenty of work for us to do here. The citizens are going to learn to comprehend their problems in a broader, newer way. Widespread popular educaton, a broad-gauged financial programme, rapid transit, better health conditions, improved housing and city planning; these are some of the problems before us. We propose to devote the energies of our staff of specialists to the welfare of the community as a whole. We are confident that when the forward looking citizens of this city understand our aims, we can stand together for a more worthy city-home.

In the recent U.S. fuel regulations, it is interesting to note a clause which states that the maximum temperature to which houses shall be heated is 68 degrees. While this has been criticized as too low a figure, it may be stated here that there are probably few houses at the present time where the standard temperature is above 68 degs. In view of the fact that the statement "overeating is a matter of habit" might well be applied in the case of overheating, if such a condition really exists, the maximum of 68 degs. seems adequate.

Practical Hints for the Contractor

that may save him time and money. If you know any labor-saving scheme, send it in—preferably with illustrations. We will pay for all accepted articles.

Tamping with a Rock Drill

WHEN it is necessary to do a considerable amount of filling on building sites, sewers, and elswhere, the problem of rendering the filled in material stable has presented certain difficulties with regard to the method of tamping. To avoid the unsatisfactory and expensive method of hand tamping, a rock drill mounted as shown, was used, according to an item in the News-Record, to tamp a slag fill 51 ft. wide and 265 ft. long containing 1,200 cu. yd. With it two men did the work of twelve men using hand rammers, and compacted the fill much better than could posibly have been done by the old method. The drill was operated by compressed air supplied through 75 ft. of ¾ in. hose. The face of the ram was made from a circular steel plate ⅝ in. thick and 10 in. in diameter welded to a piece of drill steel.

Rock drill rigged as automatic tamper.

The Integral Method of Curb Construction

AN article on the integral method of constructing curbs appearing in the Concrete Highway Magazine reads as follows:

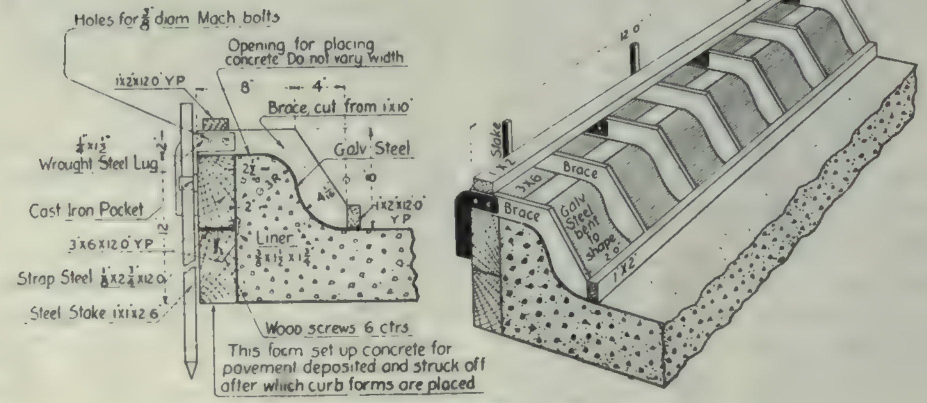
Forms of curbs should be made up of the design shown by the accompanying sketch. This form gives a curb which is ideal. It is of pleasing appearance and does not retain dirt.

In building this curb some contractors have placed their forms and filled them at the time of the placing of the concrete for the pavement proper. The difficulty with such a procedure is that the water removed by rolling and with the belt finds its way to the gutter line and must be removed by brooming. However, even with the most painstaking efforts some laitance will remain along the gutter and will subsequently check, resulting in a rough flow line.

To avoid such a condition many contractors are following the plan of placing and finishing with the roller and first belt the pavement proper, then placing their curb forms and constructing the curb. This is the method that is recommended, because of the facility in finishing, in removing the excess water, and in avoiding any laitance effect.

In order that this procedure can be followed, it is necessary that the retaining form for the curb be built up in two sections as shown on the drawing. The first section serves the purpose as a side form and permits the roller and belt to be operated over it. After the first belting, the second section of this form is placed and the integral curb mold put in position.

The only objectionable feature to such a method is that it necessitates wheeling sufficient concrete for the curbs from the mixer to where the curb forms are in place, but this additional cost is offset by the increased speed and facility which can be attained on curb finishing work.



Detail of curb section and form.

Effects of Grading of Sands and Consistency of Mix on Strength of Concrete

In the issue of July 18th, 1917, page 623, Contract Record, we reviewed a series of experiments just then completed by Mr. L. N. Edwards, supervisng engineer of bridges for the City of Toronto, on the effects of grading of sands and consistency of mix upon the strength of plain and reinforced concrete. Mr. Edwards has continued these experiments during the past year and at the recent convention of the American Society for Testing Materials gave a quantity of supplementary information on the same subject and showed a number of curves. The curves showing the compressive strengths of the test cylinders for both the "Tests for Grading of Sands" and the "Tests for Consistency of Mix" have been revised to include the strength of cylinders tested at the age of one year. The information relating to the effect of consistency of mix is augmented by the addition of the results of a test made to show the decrease of the resistance to abrasion and shock resulting from the inclusion of a water content in the mix in excess of that required "to produce a concrete, the mortar component of which is of a saturated, sticky, semi-plastic consistency."

Results of Tests.

In plotting the curves showing the compressive strengths of test specimens for ages of 90 days and under, the strengths obtained from the 90-day tests were in all cases assumed to be unchangeable, and in a few cases slight variations from plotted strengths at 7, 30 and 60 day ages were made to secure uniform, even curves. In revising these strength curves to include the 1-year test strengths it has been found advisable, in a few cases, and for the same reason, to vary from the plotted strengths at 90 days.

Tests for Grading of Sands.—Fig. 1 shows the compresive strengths obtained from the tests of the cylinders in which the twelve specially graded sands were used.

Tests for Consistency of Mix.—Fig. 2 shows the compressive strengths obtained from the tests of the cylinders in which the consistency of mix was varied from a sticky, semi-plastic to a very wet condition. In relation to the total weight of the cement and aggregates the quantity of water used in the first consistency mix was 6.17 per cent. for the 1:2:4 mix and 5.99 per cent. for the 1:2½:5 mix. This quantity was

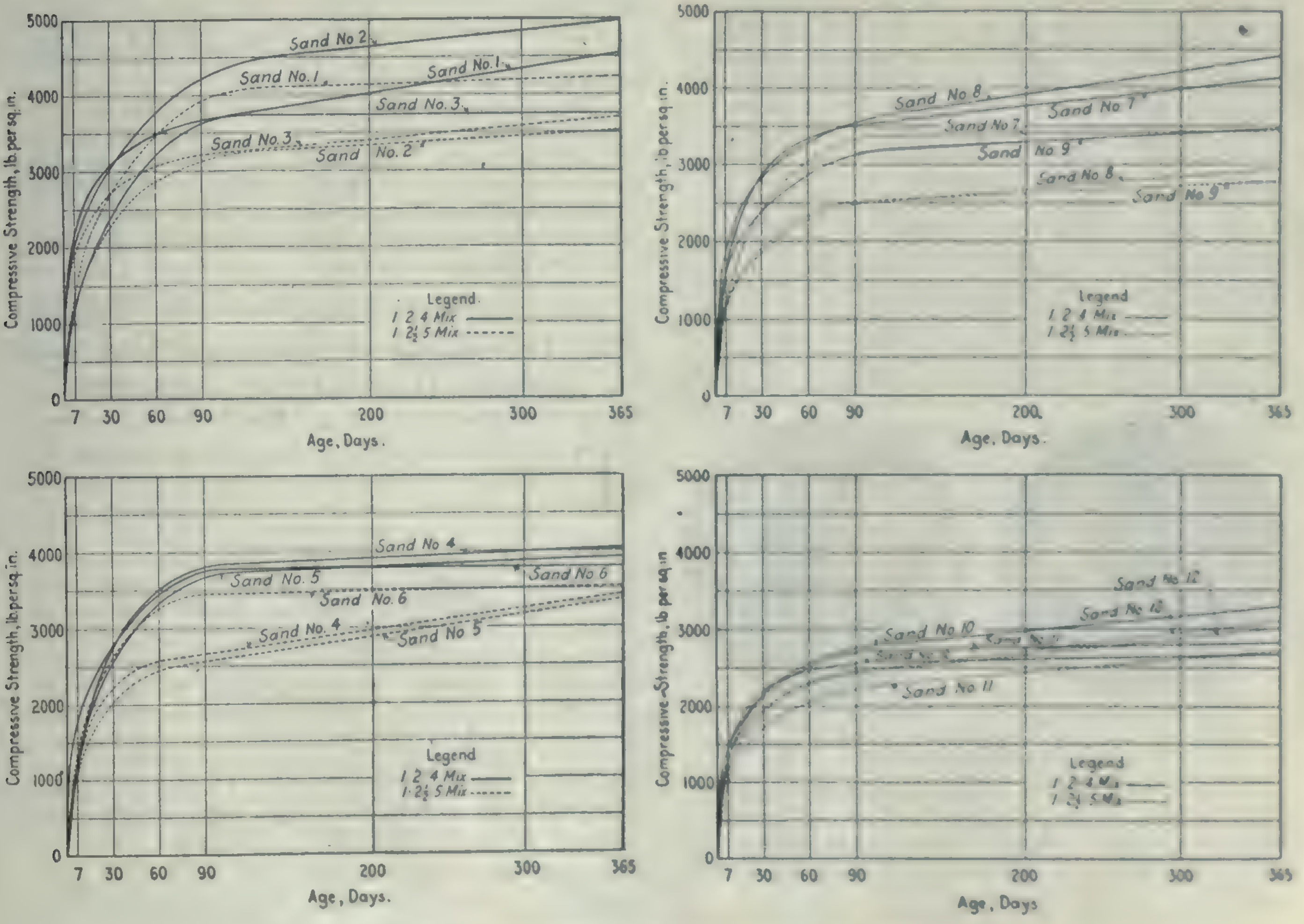


Fig. 1—Compressive strengths of test cylinders. Grading of test sands.

increased by 10, 20, 35 and 50 per cent., respectively for each succeeding mix.

In the previous paper mention was made of the condition that "the inclusion of a greater quantity of water than is required for the development of its natural functions is decidedly detrimental to the strength and reliability of the final concrete," and photographs were reproduced showing accumulations of water cavities underlying the particles of stone aggregate and the reinforcing steel tending to reduce the bearing capacity in the former case and the bond between the steel and the concrete in the latter case.

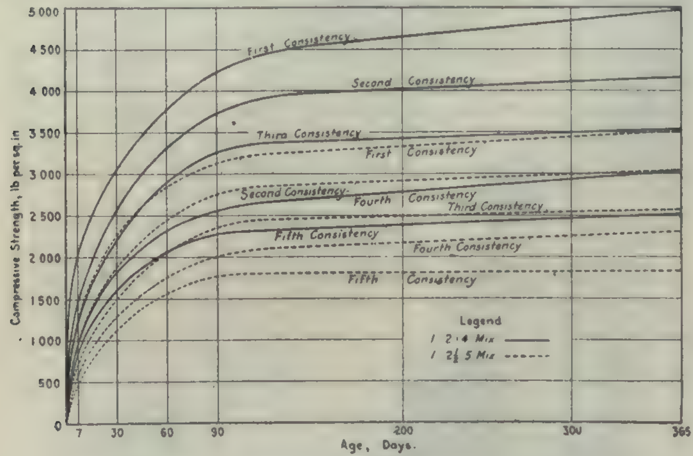


Fig. 2—Compressive strengths of test cylinders: consistency of mix tests.

A microscopic examination of the mortar portions of the concretes of the five different consistencies discloses a marked change in the physical structure of the cement matrix. Doubtless the decrease in strength found in the tests of concrete cylinders and of reinforced beams is in part due to this change in matrix.

Fig. 3 shows photomicrographs (×75) of the mortar bedding of stones in first and fifth consistency concretes. Under the microscope the cement matrix of the first consistency concrete appears gray in color and adheres closely to the surfaces of the aggregates in amorphous masses containing myriads of minute voids, but on the whole giving the impression of possessing strength, hardness and rigidity. In comparison, the cement matrix of fifth consistency concrete presents a marked difference, both in color and in physcal structure. Its color is more nearly a milky white and its structure is generally loose and flaky, giving ample evidence of a lack of strength resulting from absence of cohesion between the cement particles and adhesion between these particles and the surfaces of the aggregates.

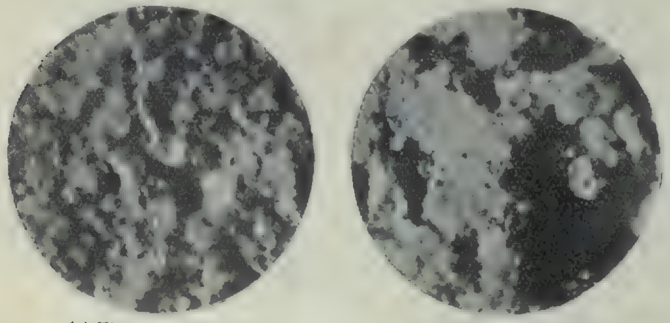

(a) First consistency. (b) Fifth consistency.

Fig. 3—Photomicrographs of mortar bedding of stone aggregate—consistency of mix tests. (×75)

Consistency-Abrasion Tests.—This test was made with the object of obtaining information relating to the influence of the consistency of mix upon concrete in relation to its resistance to abrasion and shock. The mix used was a 1:1½:3. Two sets of test cylinders were made. In the first set the stone aggregate was broken limestone of good quality and in the second set a good quality of broken trap rock was used. In the first consistency mix the water content was 6.25 per cent of the total weight of the cement and aggregates. The water content was increased by 10, 20, 35 and 50 per cent for the four succeeding consistencies. The test specimens were cast in 6-in. cylinder forms by the insertion of a metal diaphragm at about the centre of the length. Ten half cylinders were made for each consistency.

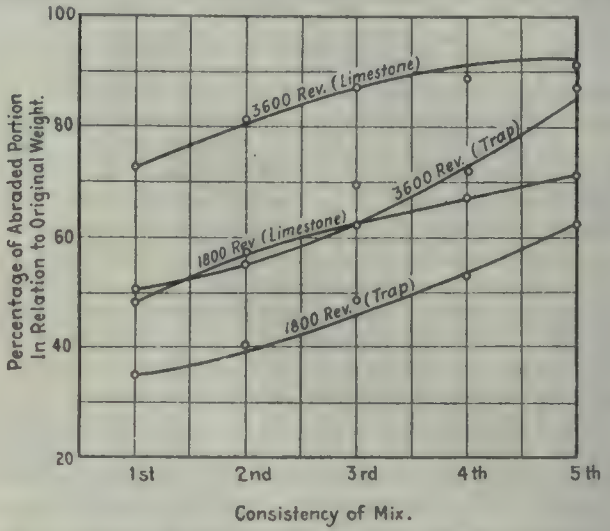


Fig. 4—Relative reductions of test specimens: consistency—abrasion test.

The specimens were tested at the age of three months by the "rattler" abrasion test commonly used for testing paving brick. Fig. 4 shows the percentages of reduction in weight resulting from 1800 revolutions and from 3600 revolutions of the machine. In this test several of the "wet" consistency specimens were entirely pulverized.

Fire Resistance of Concrete Columns Largely Depends on Aggregate

THE determination of the most important constituent of a concrete column with regard to the property of resisting fire is a subject in which we are all interested. While it is probably true that there is no such thing as an absolutely fireproof building, we are at least concerned with making a building as resistant against fire as possible. In order to attain this object, the column is perhaps of greatest importance in that it is the main supporting element of the structure. While the proportion of steel to concrete is of paramount importance in design, it has been shown in the following results of fire tests on concrete columns described in an article by Walter A. Hull, of the United States Bureau of Standards, that the aggregate is the critical element in the fire resistance of columns:

Tests were made on 18-in. round and 16-in. square columns. Round columns of 12-in. diameter were made from one aggregate with one type of reinforcement. Two kinds of reinforcement were selected; 2% vertical steel with 1% spiral steel and 2% vertical steel with no spiral steel. For comparison, columns without reinforcement were included. In all columns the a plaster coating was applied. This latter served admirably to protect the columns against heat failure. steel had a covering of 1½ in. of concrete and in some Pittsburg river gravel, of a maximum 1½-in. diameter, and Pennsylvania high-calcium limestone, ¾-in. diameter, made up the aggregate. Three columns of each kind were made up, giving check fire tests.

Tests were made in a special apparatus having a gas-fired furnace capable of raising the temperature to 1200° C., and of giving a load of 600,000 lb. If the column stood the 600,000-lb. load hot it was permitted to cool and transferred to a 10,000,000-lb machine and tested to destruction.

In the gravel-concrete columns there was a marked tendency in the concrete to break up early in the fire tests and for the resulting slabs to separate and fall off, exposing the load-bearing portion in the column. The steel was exposed. Round columns with vertical reinforcemnt only, suffered much less than those with spiral steel. Square columns vertically reinforced chipped badly. Round columns with no reinforcement showed an intermediate behavior between that of round columns with spiral steel and those without such steel. Strength tests made at the end of the four-hour fire test showed the gravel-concrete columns with spiral reinforcement had retained from less than 15% to approximately 18% of the strength of the column test without exposure to heat. A round column with vertical rods and no hooping retained approximately 30% of its strength; square columns from 15% to 20%, and a plain column approximately 23%. In the limestone column there was no surface cracking during the fire test, either in the square or the round type. The columns after cooling showed a strength approximately 77% of the maximum of the unfired column. Each of the vertically reinforced columns, both round and square without spiral steel, tested while hot at the end of the fire test, showed a maximum strength approximating 50% of that of the unfired column of the same class.

The St. John, N.B., Dry Dock and Shipbuilding Company, Ltd., has promised to complete the drydock and ship repair plant at Courtenay Bay; the dock will be 1150 feet long and 125 feet wide. It is proposed to include a steel shipbuilding plant in the scheme, but this will depend upon whether the city, county and province will grant a bonus of $500,000.

The Toronto and York Highway Commission have four important schemes under consideration—the proposed improvement of the Don Mills Road at the Robert Davies property, road diversion and high-level bridge at Highland Creek, road diversion at Locust Hill, straightening of Yonge Street at Holland Landing.

It is interesting to note that the amount of British shipbuilding for the 12 months ending May 31, 1918, was 1,406,838 gross tons, an amount twice as large as that for the preceding 12 months.

Mr. H. E. Prindle, architect, formerly of Montreal, has beeen appointed supervisor of housing, Emergency Fleet Corporation, U.S.A.

Waterproofing Concrete Ships and Other Structures

THE porosity of concrete has, in some instances, rendered its use objectionable where it is imperative to keep the water out. Various methods have been devised to overcome this difficulty both by applying an external coating and by adding a material at the time of mixing. When so many ships are now being built of concrete and it is considered that a hull weighing 3,000 tons would absorb 300 to 600 tons of water if no precautions were taken to waterproof it, it is important that an effective means of waterproofing should be used if carrying capacity is to be as large as possible. If sea water enters the concrete, rusting of the steel reinforcement and consequent cracking of the concrete surface will result, due to the increased volume of the steel. While it is necessary not only to present a water-resisting surface, the subject of freedom from barnacles and sea grass on the ship's bottom is also of importance. A number of methods for waterproofing concrete are described in the following article from the Concrete Magazine:

The application of submarine paints to the bottom of ships would be necessary to prevent the adhesion of barnacles and sea grass, and it may be thought that such paints in themselves being more or less waterproof, would protect the immersed part of the vessel from absorbing sea water. It is, however, well known that such paints after a while are penetrated by water, and that the chafes and abrasions resulting from contact with lighters, quay walls and fenders remove the paint, thereby admitting sea water into the structure of the vessel with all its attendant consequences.

It has been suggested to get iron filings into the outer structure of the concrete and that the absorption of water would cause these iron filings to swell and fill up the pores of the concrete, but this process would seem to be ephemeral insofar as the continuous combination of sea water and iron filings would ultimately cause the expansion of the latter to such an extent as to destroy the outer portions of the concrete.

Bituminous varnishes and tar have also been used but it has generally been found that these only covered the surface of the concrete and would be subject to the drawbacks resulting from abrasion.

A process which constitutes an absolute protection against penetration of sea water has recently been patented, it is claimed. This consists of a process of impregnating the outer structure of the concrete with bitumen. Bitumen varnishes of various density are used, the first being so liquid as to penetrate deeply into the concrete. These are followed quickly by slightly denser solutions which readily penetrate into the structure of the concrete till a penetration of one-fourth to one-third inch has been obtained. After this a bituminous varnish of ordinary density is applied as a surface covering whereupon an insulating coat is applied through which "no breaking through" of the bituminous preparations can take place. Over this insulating coat antifouling paints or decorative paints of any description may be applied.

Asphalt Imports Restricted

The U. S. War Trade Board has placed asphalt upon the restricted import list. Imports for the calendar year of 1918 will be limited to a total quantity of 30,000 tons from Venezuela and 32,000 from the Island of Trindad. All outstanding licenses for the importation of asphalt are revoked as to shipments made after June 15, 1918. Allocation of the amounts permitted to be imported, regulation of the price and other details will be arranged after conference with the War Industries Board.

Enemy Guns Located by Sound Ranging

SOME interesting details regarding the methods used by the French engineers for locating the enemy's guns were given in an address by Major-General Chas. M. Clement, U.S.A., before the Philadelphia Association of members of the American Society of Mechanical Engineers. The extent to which engineers have accomplished wonders in science and invention is well shown.

They have figured out the influence of the earth on a shell travelling out of the cannon; how much farther it will shoot north than south; how much the height of the moon deflects the shot, and what is called the ultimate error of the cannon shot is disappearing under their mathematics. If a commander cannot point a cannon within ten feet of the shot he is not counted a success. That is an engineering triumph and mathematical triumph of the highest degree.

Somebody asked me to-night how they located the guns and whether bw aeroplanes. I said, "Not alone. There are three ways of doing it—spot flashing, sound ranging, and then the aeroplane to check both up." The most uncanny thing is sound ranging; it is shooting around the corner, surely. They have a very delicately devised wire that is heated red hot, and so sensitive that if you blow your breath on it it goes out. They put up six or eight of these wires at different points, all connected by electricity back to the central station, and then have a moving-picture machine. When an enemy gun goes off a button is pushed and the moving-picture machine goes into action, and as the vibration of that gun reaches each one of these stations there is a little quiver in the line that is printed on that film, and when it comes out it is handed over to the officer, and he goes to a carefully calculated table and proceeds to locate that gun by the vibrations taken miles away from where the recording instrument was, transmitted underground by wires buried six feet and brought back to this little encasement of his and printed; and those little strips of paper come back and locate the gun that fired that shot. Then he proves it by spot flashing, and as the sound travels from one place to another a number of people push a button, and, knowing that sound travels so many meters a minute, they prepare a map on which to locate it. Because paper expands and contracts, they make the map of zinc and they cut the paper in two-inch squares, so that nothing in accuracy shall be lost by the expansion or contraction of the paper under heat and dampness. They have a parabola around it with everything calculated and stretch six strings around that, and when the six strings get over the same spot there is the gun, and when the other six strings get over there they are sure it is there, and then they get the airmen to fly over it, and he can see if they are right, and it is nine out of ten if they drop a shot over there that that gun goes out of business. That is engineering gain. That is progress beyond the point where men set up a right-angled corner to set up a stone wall to put up a cheap house.

To-day, although ships are being sunk, they are not being destroyed as fast as we are building them, while German submarines are being sunk faster than the Germans are building them.—Viscount Jellicoe, former First Sea Lord, at Southampton, on July 10.

Mainly Constructional

East and West—From Coast to Coast

Oldfield Apartments, Ltd., has been incorporated, with a capital of $250,000, head office at Montreal.

Permits to the value of $80,535 were taken out in Galt, Ont., during the first half of the year. This is a considerable increase over the corresponding period in 1917, when the total was $58,890.

The Port Hammond Cedar Mill Company are making extensive additions to their plant at Port Hammond, B.C., which when completed will double the capacity of their shingle plant and lumber mill output.

During the first six months of this year there were 77 building permits issued in Peterboro, Ont., at a value of $174,945. Eleven of these were for dwellings. Last year during the corresponding period there were 87 permits issued, valued at $95,888.

Work has been commenced on the erection of the new factory building for the Huntley Mfg. Co., Ltd., at Tillsonburg, Ont., the contract for which was awarded Messrs. Ponsford & Green, of St. Thomas. It will be rushed to completion as rapidly as possible.

Brantford Buildings, Limited, the company formed by Brantford business men to relieve the housing situation in their city, has broken ground on Sarah street for six new dwellings. McEachren Brothers, of Toronto, are to carry out all construction work for this company.

The Bedford Construction Co. (formerly Cavicchi & Pegano) have been awarded the contract for the construction of the shipyards for Halifax Shipyards, Limited. It is predicted by the officials that the first of the three shipbuilding berths will be completed within four months' time.

The city property committee of Toronto have approved the proposal of the special committee of civic departmental heads to permit conversion into three-family apartments of dwelling houses within the area bounded by Bloor and Howard Streets, Bathurst Street, Parliament Street and the Bay.

The total value of building permits issued in Regina for the month of June is about $72,000, as compared with $44,000 during the same month in 1917. The most important building in last month's figures is the new grandstand for the Exhibition grounds, which is estimated at a value of $50,000.

The buildings trades council of Toronto has elected the following officers for the ensuing year: President, Edward Madden; vice-president, M. Bennington; financial secretary, Sam Lawrence; corresponding secretary, Robert Towler;

inductor, Joseph Potter, and trustees, delegates Bonner and Bradfield.

Montreal's building permits for June number 190 and are valued at $287,560, as compared with 191 at a value of $357,745 in the same month last year. For the first six months of this year the total is 825 permits, value $2,039,565, while for the corresponding period in 1917, the figures were 861 permits, at a value of $2,466,659.

Vancouver building work, as indicated by the permit issues, is keeping well ahead of last year. Last month there were 61 permits issued at a value of $59,300, as against 39, valued at $42,555, in June, 1917. The total for the half year is 372 permits at a value of $665,855, which compares with 261, valued at $323,894 for the corresponding period in 1917.

Work on the Gouin Boulevard, which will provide a tourist route through the Gatineau district and the Laurentian mountains, will likely be started this fall. Sir Wilfrid Laurier recently discussed this proposal with the members of parliament in the districts concerned, and it was very favorably received. It was requested, however, that the making of the Montreal to Ottawa highway into a first class road be linked with the scheme.

The council of Whitby, Ont., decided at a recent meeting that the portion of the Kingston Road passing through the town should be repaired at once. The department of highways have offered to loan for this purpose machinery and a gang of men at present working on the government's portion of the road on either side of Whitby. No charge will be made for the use of the machinery and the town will therefore only have to bear the expense of the men's wages.

Finance Commissioner Bradshaw suggests as a solution of the housing problem in Toronto a scheme which has been tried out with great success in Britain. He proposes that the construction of dwellings for workmen be undertaken by the employers of labor, while the city could, if necessary, lend aid by guaranteeing bonds. There are plenty of suitable sites close to the thickly populated employment centres, the commissioner says, and on these the employers could erect self-contained houses of about six rooms, at an approximate cost of $2,000, on a lot with about 25 feet frontage.

A company, whose business will be the manufacture of emery or carborundum wheels, is negotiating with the council of Renfrew, Ont., with regard to the establishment of a plant in that town. The firm asks for fixed assessment and water rate, and it will erect a plant to cost some $150,000, also building dwellings for its workmen. From 3,000 to 5,000 h.p. of electrical energy will be required. The city council will submit a by-law to the ratepayers providing for fixed assessment and water rate, and permission for the Calabogie Power Co. to furnish the necessary power.

The Eastern Ontario Good Roads Association has recently been formed. The organization meeting was held at Ottawa, 300 representatives from the eleven counties of Eastern Ontario attending. Officers were elected, a board of directors and executive committee appointed, and a definite programme of highways to be constructed, was drawn up for presentation to the provincial government this fall. Tentative arrangements were made to send a deputation to Toronto to urge the building of a highway from Ottawa to Petawawa Camp, a portion of the highway from Ottawa to Point Fortune, Que., as a link in the proposed Ottawa-Montreal trunk road, and another highway from Ottawa to Morrisburg.

Commissioner Hilyard, of St. John, N.B., states that he will recommend that a new water service be provided for East St. John as soon as the provincial government decides to fill in the bridge near the Municipal Home and place a culvert there. He has also directed the city engineer to prepare a report on the proposed extension of the 36-inch main laid last year to Manchester's Corner, Manawagonish Road, following the receipt of a petition from residents of Lancaster for a better water supply. If the work is undertaken, it will probably be continued in reinforced concrete pipe, similar to that which is to be laid around Lake Fitzgerald. It is stated that the Lock-joint Pipe Company will begin laying pipe at Lake Fitzgerald next month.

At a recent meeting in Gananoque, Ont., under the auspices of the board of trade and town council, Mr. W. A. McLean, Deputy Minister of Highways, announced that the provincial government would at once take over the stretch between Napanee and Kingston as part of the national highway which is eventually to connect Toronto and Montreal. Mr. McLean was accompanied by Hon. Geo. S. Henry, Minister of Agriculture, and party of fifteen others, including many prominent good roads' men. The party made a tour of inspection of the roads of Frontenac county and visited Kingston, the object of their trip being the furtherance of the government's trunk road scheme. They also crossed the line and were given a run over the New York state road from Clayton to Ogdensburg.

In preparation for the next winter-port season, the Federal Government has planned to carry out considerable work in West St. John and will endeavor to have it completed by January 1 next. Tenders for the reconstruction of the breast work at Fort Dufferin were received up till July 17, and work will be started as soon as the contract is let. Plans are completed for the repair of the end of No. 7 berth and putting additional ballast in the structure, also for the extension of the conveyor system to berths 14 and 15, calling for a wooden construction in place of steel. Tenders for this work will probably be called in the near future. The C. P. R. is also carrying out improvements, having let a contract to Messrs. Grant & Horne for the reconstruction of the gallery to No. 1 berth. The demolition of the old structure has been finished and good progress is reported on the new gallery.

The plans prepared by Mr. R. O. Wynne-Roberts, of Toronto, for the new pumping station in Sault Ste. Marie, Ont., which is to be located on Superior Street, have been approved by the water and light commission. The machinery, which in itself will cost $30,000, has already been contracted for and the plan is to have the building completed and ready for use by October 20. The pump house will be 53 ft. x 55 ft., with a wing at the rear 30 ft. square, and will be two storeys high. It will be used as the permanent electric sub-station for the city as well as for pumping purposes. There will be six electric pumps installed, three for domestic use and three in case of fire. The intake will be located on the south side of the head race of the canal to the new power house, with an emergency intake in the ship canal. The water is to be chlorinated by the chlorine gas method. Chairman Shannon, of the commission, states that the whole scheme is a temporary one to meet war conditions, involving an expenditure of $100,000 or $125,000 instead of $500,000 or $600,000, as it would cost to go to Coldwater Creek.

Personals

Mr. W. A. James has been promoted to the position of assistant chief engineer of the C. P. R. western lines.

Mr. S. H. Frame has been appointed assistant engineer of the Department of Natural Resources of the C. P. R., with headquarters at Brooks, Alta. He was previously district hydrometric engineer of the Irrigation Branch, Department of the Interior, Calgary.

Mr. R. T. Grant Jack, formerly resident engineer, Sewer Section, Department of Works, Toronto, recently left the employ of the city to take a position on construction work with the Leaside Munitions Company. Mr. Jack is a [illegible] graduate in civil engineering of the University of Toronto.

Tenders and For Sale Department

FOR IMMEDIATE SALE
MACHINERY
From Marble and Freestone Cutting Plant

3 -Gang Saws.
4 -Polishing Jennys.
3 Planers (2 with carborundum attachment)
1 Myers diamond saw.
1 -Patch carborundum Planer.
2 Baluster Lathes.
4 Column Lathes.
2--Rubbing Beds.
Motors..2, 5, 12, 25, 115 H.P., 3 phase, 25 cycle,
Pulleys (wood and iron), shafting, belting (leather and canvas).
Terrazzo crusher, drill press, etc., etc.

Can be inspected at 355 Logan Avenue, Toronto.

THE NORCROSS BROTHERS COMPANY

29-30

Parliament Building, Ottawa

Tenders Wanted
for
Lavatory Marble, etc.

Sealed tenders will be received by the undersigned until noon, **August 2, 1918**, for the Marble of the Lavatories, etc., required in the reconstruction of the above building.

All tenders to be based on the supplying, execution, erection and completion; together with the furnishing of all material, tools, appliances, labour, etc., necessary and described by the plans and specifications for "Lavatory Marble, etc."

The work of this contract shall be proceeded with immediately upon the signing of the contract, and as may be directed and in such a manner as to ensure the completion of the marble work of this contract contained in the two Office Block sections of the building, by October 15, 1918, and the balance by August 1, 1919.

Plans, specifications, and any other information required can be obtained at the office of the General Contractors, P. Lyall & Sons Construction Company, Limited, Ottawa.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Minister of Public Works, for a sum not less than five per cent (5%) of the amount of the tender, which will be forfeited if the parties tendering decline to enter into a contract when called upon to do so. If the tender is not accepted, the cheque will be returned. If the tender is accepted, an additional cheque for a sum equivalent to five per cent. (5%) of the amount the tender must be deposited before the contract is signed. The total security will be forfeited if the contractor fails to complete the work contracted for.

Certificates of payment shall be issued monthly as the work progresses and shall not exceed in the aggregate ninety per cent. (90%) of the value of the labour and material furnished and set out in the work.

Samples must be submitted with tender.

The lowest or any tender not necessarily accepted.

Envelopes containing tenders to be marked: "Tender for Lavatory Marble, etc.," and addressed to the undersigned.

JOHN A. PEARSON, Architect,
J. O. MARCHAND, Associate.

Centre Block, Parliament Hill,
Ottawa. 29-30

For Sale by Greater Winnipeg Water District

Forty 20-yard Air Dump Cars, built by Canadian Car and Foundry Co. Steel body and wood floor. Length 26 feet, width 9 feet, length over end platforms 29 feet. Built 1915. In A1 condition.

Twenty-five 16-yard Air Dump Cars, built by Western Wheel Scraper Co. Steel body, wood floor, steel lined. Length 26 feet 1 inch, width 9 feet; length over all, 30 feet.

Half of above cars ready for delivery October 1st, 1918. Half for delivery December 1st, 1918.

Further information upon application.

All of above offered subject to prior sale and f.o.b. Paddington Transfer, St. Boniface, Man.

Bids will close 12 noon, August 1st, 1918, and should be addressed to the undersigned.

R. D. WAUGH,
Chairman of Commissioners,
Greater Winnipeg Water District.

501 Tribune Building,
Winnipeg, Man. 29-29

Parliament Building, Ottawa

Tenders Wanted
for
Water Tanks and Pumps

Sealed tenders will be received by the undersigned until noon, **July 30, 1918**, for "Water Tanks and Pumps" required in the reconstruction of the above building.

All tenders to be based on the supplying, erection, installation and completion; together with the furnishing of all material, tools, appliances, labour, etc., necessary and described by the plans and specifications for:

(a) Three (3) water tanks;
(b) Two (2) centrifugal pumps.

The work of this contract shall be proceeded with immediately upon the signing of the same and in such a manner as to ensure the completion thereof by August 14, 1918.

Plans and specifications, and any other information can be obtained at the office of the General Contractors, P. Lyall & Sons Construction Company, Limited, Ottawa.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Minister of Public Works, for a sum not less than five per cent. (5%) of the amount of the tender, which will be forfeited if the parties tendering decline to enter into a contract when called upon to do so. If the tender is not accepted the cheque will be returned. If the tender is accepted, an additional cheque for a sum equivalent to five per cent. (5%) of the amount of the tender must be deposited before the contract is signed. The total security will be forfeited if the contractor fails to complete the work contracted for.

Certificates of payment shall be issued monthly as the work progresses and shall not exceed in the aggregate ninety per cent. (90%) of the value of the labour and material furnished and set out in the work.

The lowest or any tender not necessarily accepted.

Envelopes containing tenders to be marked: "Tenders for Water Tanks and Pumps." and addressed to the undersigned.

JOHN A. PEARSON, Architect,
J. O. MARCHAND, Associate.

Centre Block, Parliament Hill,
Ottawa. 29-29

Steel Rails For Sale

A small quantity of 20 lb. light re-laying rails, for sale for immediate delivery. Apply Box 759, Contract Record, Toronto, Ont. 28-31

FOR SALE
Stone Quarry Machinery

One Revolving Screen, 4 ft. x 25 ft.
One No 6 Crusher.
One No. 14 Cyclone Well Drill.
Seven Steel Side Dump Cars, 1 yard, 24 gauge.
Two Turntables, 5 ft. diameter.
One 45 H.P. Steam Engine.

The above are nearly new and will be sold cheap. Must be moved at once.

CRUSHED STONE LIMITED,
47 Yonge Street Arcade,
28-28 Toronto, Ont.

Parliament Building, Ottawa

Tenders Wanted
for
COAL and ASH Handling Equipment

Sealed tenders will be received by the undersigned until noon, **August 2, 1918**, for the Coal and Ash Handling Equipment required in the construction of the Central Heating Plant of this building.

All tenders to be based on the supplying, execution, installation, and completion; together with the furnishing of all material, tools, appliances, labor, etc., necessary and described by the plans and specifications for the Coal and Ash Handling Equipment.

The work of this contract shall be proceeded with immediately upon the signing of the contract and continued in such a manner as to ensure the completion thereof by October 1, 1918.

Plans, specifications, and any other information required can be obtained at the office of the General Contractors, P. Lyall & Sons Construction Company, Limited, Ottawa.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Minister of Public Works, for a sum not less than five per cent. (5%) of the amount of the tender, which will be forfeited if the parties tendering decline to enter into a contract when called upon to do so. If the tender is not accepted, the cheque will be returned. If the tender is accepted, an additional cheque for a sum equivalent to five per cent. (5%) of the tender must be deposited before the contract is signed. The total security will be forfeited if the contractor fails to complete the work contracted for.

Certificates of payment shall be issued monthly as the work progresses and shall not exceed in the aggregate ninety per cent. (90%) of the value of the labour and material furnished and set out in the work.

Each tender must be accompanied by detailed drawings of the equipment it is proposed to furnish for the amount of the tender.

The lowest or any tender not necessarily accepted.

Envelopes containing tenders to be marked: "Tender for Coal and Ash Handling Equipment," and addressed to the undersigned.

JOHN A. PEARSON, Architect.
J. O. MARCHAND, Associate.

Centre Block, Parliament Hill,
Ottawa. 29-30

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Make Production the Basis of Labor's Wage

IN looking back over the labor troubles and disputes that, during the past few weeks, have threatened a tie-up of manufacturing and transportation industries, one cannot but be impressed with the tremendous pressure being put upon all classes of labor by the increased cost of living and, in casting about for a solution, one hesitates to suggest that in proportion to the absolutely essential expenses towards the maintenance of a household the labor man is too well paid. There remain in fact two much more promising alternatives than a reduction in wages—the first is to limit the prices of commodities the labor man must purchase; the second is to change the basis upon which a man's worth is figured.

Perhaps the first alternative may be dismissed with a mere mention. This is a matter so closely associated with the prosecution of the war that only those having intimate knowledge of all the circumstances would be justified in offering suggestions. We must presume that our government is doing all that can be done. Undoubtedly it is a most difficult work and at least we must remember that cost and production are so intimately associated that to limit the first may endanger the second. High prices is a condition that hits us all alike, and after all, when the smoke clears away and we see all these things in the proper light, the place of the profiteer will be an unenviable one—probably second only in the contempt of right thinking men to the brutal Hun himself.

But what of the second alternative? We were told recently by a contractor that not only were his pay-sheets practically double what they were formerly, but the amount of work his employees turned out was only about half what it used to be. Also employees were much more careless, and liable to "jump" the job at the slightest provocation. Herein, we think, lies a fact that is, in a large measure, responsible for the high cost of manufacturing and building. The basis of a day's work is the "pay" it brings—not the amount or quality of the work accomplished. One does not need to travel farther afield than the first corner, where laborers may be seen sweeping the streets, gathering garbage, setting poles or digging sewers, to realize that the term "laborer" has lost most of its original significance and is now largely a misnomer. The pace at which these men work is suggestive of nothing so much as the old-time country funeral procession. For the most part they are engaged in discussions—almost invariably a criticism of the firm or corporation for which they work. Their attitude is that of an habitual "grouch." No thought of their work, apparently, or of their duty to their employers ever enters their heads to disturb the flow of vituperation and discontent.

Certain industries, fortunately situated, have been able to stem this tide of labor langour by adopting the principle of piece-work. The effect on production, of course, has been phenomenal, the increase running into hundreds of per cent. and the only objection seems to be a possibility that under these conditions the pressure becomes so great that a man breaks down. However, is it an old saying that it's better to wear out than rust out.

Everything considered, the solution of our labor troubles and the high cost of living at the same time seems to offer greatest promise along this lead—a real day's work for a real day's pay. Up to date we are following the line of least resistance—it is so easy to raise the men's wages and take it out of the poor consumer—but we are satisfied there is little improvement in sight until manual labor is judged on the same basis as other types of labor—the competitive basis of its true value to the employer. Here is where the "Union" ignominiously fails and must fail. Every man, whether he works chiefly with his hands or his head, has a real market value. When we shall have established a basis upon which this may be judged we shall have gone a big step towards rooting out one of our biggest evils—measuring a day's work in dollars and cents.

Convention Devoted to House Building

IN view of the shortage of houses, which has been as noticeable in the United States as in Canada, the American Concrete Institute at their recent convention devoted a very considerable part of the programme to papers and discussions dealing with the history, construction and utility of concrete houses for working men. A committee on industrial concrete houses had been appointed some time previously, and this committee made a report. There were some points on which they had been unable to confer, however, and as a result a number of short papers were presented by various members of this committee, outlining the views and experiences of each. On account of the importance of the subject of small houses at the moment and the apparent possibilities in the way of building these of concrete, extracts from the report are given in this issue, and also a number of the papers dealing with the advantages and disadvantages of concrete houses, their methods of construction, the interior planning and the architectural design. We are of opinion that contractors who up to the present time have specialized in the standard house of stone or brick and wood will do well to make a careful study of the possibilities of the concrete house as a solution in the very near future of the present alarming house shortage.

Trying to Prevent Collusive Bidding

FOLLOWING previous articles on the wide difference between bids submitted by contractors on the same section of work and the need for reforms, we have another objectionable feature in that of the unbalanced bid. In bidding on certain items of construction it has been noticed that one contractor will bid a certain specified sum at a rate which allows for a legitimate profit, while his competitor will bid on this same item as much as 25 per cent. lower. If this was the only detail on which bids were to be submitted and the lower tender accepted, there would be no doubt of the resultant loss to the contractor, but he makes up this 25 per cent. on the next division of the contract by bidding high—in other words, he "cooks" his bid.

At a recent meeting of the Massachusetts Highway Association the following resolutions were passed with but one dissenting vote:

> Resolved, that in the opinion of this association, when in competitive bids any item is offered at manifestly less than its actual cost, such bid should be rejected as "unbalanced," unfair and against the interest of the municipality.
>
> Resolved, that in the opinion of this association, when the same person, or persons, are interested in two or more bids made in different names, in competition for the same work, all of such bids should be rejected as collusive and against the interests of the municipality.

The solution seems to be the universal adoption of a system of public contracts which makes unbalanced and collusive bidding unattractive by:

1. Carefully prepared estimated quantities and specifications which themselves make unbalanced bids unattractive.
2. Prompt rejection of all bids which bear evidence of being unbalanced or collusive.
3. Award of contracts to the next bidder (unless there is some good, independent reason for its rejection), without readvertising, thus avoiding giving the dishonest collusive or unbalanced bidders a second chance through readvertisement.

When these simple rules are the universal practice in letting public contracts, collusive and unbalanced bidding will be a practice of history only.

The board of education of Hamilton, Ont., has approved an agreement with the Invalided Soldiers' Commission, which provides that a second unit of the technical school be erected for the re-education of returned men, the government to pay the entire cost.

Military Hospitals Construction

The Public Works Department have invited tenders for the construction of several buildings in connection with the military hospitals department. At St. Anne de Bellevue, P.Q., it is proposed to erect orderlies' and nurses' dormitories, a storage building, and a house for the medical officer, these being in addition to the large hospital there, the contract for which was let to E. G. M. Cape & Co., Ltd., Montreal. The orderlies' building will contain on the first floor dormitories, recreation room, dining room, kitchen and store, and on two next floors dormitories and lavatories. The nurses' building is to be of three storeys, with bedrooms, recreation, writing, reception and dining rooms and kitchen on the first floor; bedrooms on the second floor, and a recreation room and bedrooms on the third floor. The storage house, of two storeys, will have compartments for the storage of meat and butter, and refrigerating rooms with the necessary machinery. The partitions for the cold storage rooms will have double sheathing of ⅞-inch kiln dried pine, tongued and grooved. A contract for grading and road work is also to be let. At Halifax it is proposed to construct an isolation hospital of three storeys.

All the buildings are practically of similar construction, with minor details to meet the varying conditions. The buildings are frame construction on concrete pier foundations up to the ground level. The exterior walls are to be of 2 x 6 inch studding sheathed on the outside and inside with ⅞-inch spruce. The exteriors are to have a covering of two-ply waterproof paper, furring, wire lath and stucco, and the inside partitions are to be of spruce or hemlock. The roof will have spruce rafters. The floors are to be of ⅞-inch hemlock.

Conference of Building and Construction Interests

A tentative programme has been drawn up by the special committee of the Montreal Builders' Exchange appointed to make arrangements for the proposed conference of building and construction interests at Ottawa. The object is to study the best means by which the building and construction interests of Canada can further the general re-adjustment which is necessary both for the balance of the war period and for the reconstruction after the war. All builders, including contracting engineers, general contractors, sub or trade contractors, and dealers in building supplies, are eligible, whether appointed delegates of organizations or representing individual firms or companies. The committee are desirous that all those who intend to be present should notify the secretary by September 15th.

The tentative programme, which has been forwarded to the various exchanges for approval or suggestion —includes the discussion of the future usefulness of builders' exchanges, also estimating; quantity surveying and cost plus fixed sum; tenders—method of calling and opening bid bond and cheques and contract bonds; contracts—standard agreements, unit prices, etc.; labor—labor and trade parliaments; employees' apprenticeship and technical education. Future business: Materials Committee—resources, economy, adjustment, consideration; future business—industrial housing, concrete roads, ets., contract farming. Business Relations: Public works, architects, engineers and owners; sub-contractors and supply houses; powers of superintendent or inspector and arbitration; foreign competition and plan making. Building by-laws and lien laws committee.

The conference will last four days, and the programme contemplates both private and open meetings, the former mainly of the sections, and a number of recreations, including a golf tournament.

Employment as Indicated by Building Permits

Activity in the building trades, as indicated by the value of building permits issued in 35 cities, showed a decrease during June as compared with the previous month, the total value of building permits falling from $4,838,053 in May to $3,667,399 in June, a decrease of $1,171,554, or 24.2 per cent. Manitoba and Alberta recorded increases, while Saskatchewan remained practically stationary. As compared with the corresponding month of 1917, there was a decline of 9.2 per cent., the value for June, 1917, being $4,038,511. In this comparison there were gains in Nova Scotia, Ontario, Saskatchewan, Alberta and British Columbia.

Of the larger cities, Toronto reported increases both as compared with the preceding month and with June, 1917. Winnipeg showed a gain as compared with May, but a decline as compared with June of last year. Montreal recorded decreases in both cases, while at Vancouver there was a decline as compared with May and an increase in comparison with June, 1917. Of the smaller centres, Three Rivers, Fort William, Peterborough, Regina, Calgary and Edmonton all showed increases in both comparisons.

Estimated Cost of Building Work as Indicated by Building Permits Issued in Thirty-five Cities

City	June, 1918	June, 1917	June, 1918, compared with June, 1917 Increase (*) Decrease (†) Amount	Per cent.
Nova Scotia	**$ 259,479**	**$ 141,613**	***$117,866**	*** 83.23**
Halifax	200,086	102,750	* 97,336	* 94.73
Sydney	59,393	38,863	* 20,530	* 52.82
New Brunswick	**24,155**	**77,785**	**† 53,630**	**† 63.95**
Moncton	21,905	15,035	* 6,870	* 45.69
St. John	2,250	62,750	† 60,500	† 96.41
Quebec	**440,726**	**977,909**	**† 537,183**	**† 54.93**
Montreal Maisonneuve	297,560	706,645	† 409,085	† 57.89
Quebec	48,300	86,179	† 37,879	† 43.95
Sherbrooke	8,300	92,360	† 84,060	† 91.01
Three Rivers	76,200	47,680	* 28,520	* 59.82
Westmount	10,366	45,045	† 34,679	† 76.99
Ontario	**1,926,599**	**1,577,029**	*** 349,570**	*** 22.17**
Brantford	55,235	21,495	* 33,740	*156.97
Fort William	158,500	25,190	* 133,310	*529.22
Guelph	8,993	3,322	* 5,671	*170.71
Hamilton	273,653	288,020	† 14,367	† 4.99
Kingston	32,230	10,192	* 22,038	*216.23
Kitchener	5,040	14,450	† 9,410	† 65.12
London	58,200	150,230	† 92,030	† 61.26
Ottawa	102,500	137,117	† 34,617	† 25.25
Peterborough	100,040	38,165	* 61,875	*162.13
Port Arthur	6,359	13,268	† 6,909	† 52.07
Stratford	9,760	19,396	† 9,636	† 49.68
St. Catharines	61,375	22,300	* 39,075	*175.22
St. Thomas	7,220	5,055	* 2,165	* 42.82
Toronto	1,006,314	692,794	* 313,520	* 45.25
Windsor	41,180	136,035	† 94,855	† 69.73
Manitoba	**440,760**	**762,700**	**† 321,940**	**† 42.21**
Brandon	8,360	7,500	* 860	* 11.47
Winnipeg	432,400	755,200	† 322,800	† 42.74
Saskatchewan	**315,465**	**308,755**	*** 6,710**	*** 2.17**
Moose Jaw	68,675	14,440	* 54,235	* 37.56
Regina	70,280	44,525	* 25,755	* 57.84
Saskatoon	176,510	249,790	† 73,280	† 29.34
Alberta	**199,775**	**138,800**	*** 51,975**	*** 37.45**
Calgary	133,680	101,300	* 32,380	* 31.88
Edmonton	57,175	37,500	* 19,675	* 52.47
British Columbia	**69,440**	**53,920**	*** 15,520**	*** 28.78**
New Westminster	3,750	5,880	† 2,130	† 36.22
Vancouver	59,300	42,555	* 16,745	* 39.35
Victoria	6,390	5,485	* 905	* 16.50
Total—35 cities	**$3,667,399**	**$4,038,511**	**†$371,112**	**† 9.19**

J. Grove Smith, fire prevention advisor of the Conservation Commission, recently went to Pembroke, Ont., in company with Fire Chief Graham, to advise regarding the rebuilding of the burned area, fire department organization and water supply.

St. Johns Short of Houses

St. Johns, Nfld., is another city that is waking up to the seriousness of the housing problem. A meeting was recently convened by Mr. Jas. McGrath, president of the Longshoremen's Union, at which the situation was discussed, and it was shown that the existing conditions were deplorable. Representatives of the various trade and other unions of the city were present, and it was decided that the workers themselves would have to tackle the problem. It is proposed to form an association to be known as the Dominion Co-operative Building Association, Limited, a company capitalized at $702,000. This company would be looked after by nine directors, including the president and vice-president, secretary and treasurer. Mr. Jonas Barter is chosen as architect, and Hon. M.B. Gibbs as solicitor. It was pointed out that each of 6,750 members of this association by contributing 20 cents per week would raise $70,200 per year, and the annual expenditure on the building, of, say, fifty houses, at $1,200 each would be $60,000. Five thousand more citizens besides those in the Unions are expected to co-operate, so that the money will be easily raised. It is planned to have the houses of different grades, say, 350 at $1,200 each, 100 at $1,500, and 50 at $2,000. Each member would contribute $10.40 a year, or $104 for ten years, and would eventually own his own home. Concessions will be requested from the government whereby cement may be imported free, thereby lessening the cost of building. A $1,200 house would be rented at $9 a month and would be equipped with electric light and sanitary appliances. The $1,500 type of dwelling would rent at $10.50, and so on, in proportion. Plans have also been suggested for the building of double houses at $1,600 each. It is the intention to build in time 800 comfortable modern houses for the workers.

This scheme has the support of His Excellency Sir A. Harris, besides the dignitaries of the churches, many ministers of the cabinet, and prominent citizens of St. John's, so that its success seems practically assured.

St. Andrews College for Military Purposes

The work of altering St. Andrew's College in North Rosedale, Toronto, so that it will meet military hospital requirements, has been commenced, and it is expected that it will be ready for occupation by September. The present plans in connection with this hospital also call for the erection of twenty-five new buildings, as follows: Isolation hospital, five convalescent cottages, dining hall, central heating plant, stores department, garage, morgue, orderly quarters, vocational workshop, therapeutic hut, hydrotherapy building, surgical cottage, two neurological buildings, four active treatment huts, administration building, medical officers' residence, nurses' home. The proposed buildings will be of frame construction with stucco on wire lath on the outside, the interior to be lined with wall boarding. A handsome promenade has been planned, to run diagonally from west to east through the centre of the grounds, ending at the east side by the college buildings.

The construction of a standard gauge railway from Kimsquit to Garde Pass, about 250 miles north of Vancouver, is under way. The railway is being built by Pacific Mills, Ltd., large paper and pulp manufacturers at Ocean Falls, to open up immense timber limits owned by the company. It will also further the development of rich mineral claims which abound in that territory.

Eastern Ontario Organizes for Good Roads

EASTERN Ontario is taking up the good roads' cause with a whole-hearted enthusiasm which augurs well for the development of that section of the province when the war is over and the long halt in construction work will have to be made up for with re-doubled energy and determination. On July 8, an organization meeting was held in the city hall at Ottawa, at which the Eastern Ontario Good Roads Association was formed. It is said that there has seldom been such a large and representative gathering of citizens of all Eastern Ontario as upon this occasion and those who have attended good roads meetings in various parts of the province state that it was one of the largest and most enthusiastic they have ever seen.

In the absence of the Mayor, Controller Napoleon Champagne gave an address of welcome and expressed his good wishes for the success of the movement.

Alderman Wm. Findlay, of Ottawa, to whom the greatest credit is due for setting the ball rolling, was unanimously elected chairman of the meeting, on the motion of ex-Alderman L. E. Stanley, seconded by ex-Mayor Fred Cook. Alderman Findlay said the Ottawa Committee was tremendously gratified at the response to the call sent out to discuss the proposal to organize the Eastern Ontario Good Roads Association. While two good roads were now practically under way—the Ottawa-Prescott and Morrisburg roads—the committee interested thought they should look further afield, and consider the whole scheme of good highways for the eastern part of the province. "I had the pleasure," said the Alderman, "of moving in the council that a permanent civic committee on good roads be appointed, to consist of two members of the council and two members to be designated by the various business bodies and clubs in the city, including the Board of Trade, members of the Labor Council, the Rotary Club, Kiwanis Club and Retail Merchants' Association." Alderman Findlay went on to say that the motion stated that it was the duty of the proposed civic committee to seek the co-operation of the various communities, county councils, townships and incorporated towns and cities, in the work of providing, if possible, a serviceable system of roads throughout Eastern Ontario. At the first meeting to organize the Ottawa committee, they were favored with the attendance of representatives from the counties of Carleton and Renfrew, who made so many good suggestions enlarging on the scope of the work they had in mind that it was decided to adjourn that meeting and call an organization meeting of the new association. Letters of invitation were thereupon written to the members of the House of Commons in the counties named—the counties as far west as Frontenac—to the members of the Ontario Legislature, to the publishers of all newspapers within that section, the reeves of all townships and the mayors of all incorporated towns and cities, and the present meeting was the result. Alderman Findlay mentioned that he had letters from many people, among them Sir Thomas White, Hon. Howard Ferguson, Hon. T. W. McGarry, expressing the greatest approval. The meeting was then thrown open for suggestion as to the formation of the association and any matter of policy connected with it.

A motion that organization be proceeded with, and that the name of "The Eastern Ontario Good Roads Association" be adopted, moved by C. J. Foy, of Perth, and seconded by E. Proulx, M.P., was unanimously carried. It was agreed that the objects of the Association should be to foster the study of road building and maintenance; to promote the improvement of the highways of eastern Ontario; and to secure co-operation in connecting various county good roads systems, thus ensuring a continuous system of improved highways throughout the eastern part of the province. The following suggestions for the organization of the association were then adopted:

Membership.—Membership in the Association shall be limited to persons residing in the following counties: Frontenac, Leeds, Lanark, Renfrew, Grenville, Dundas, Carleton, Russell, Prescott, Stormont, Glengarry and incorporated towns and cities separated from the counties for municipal purposes.

Meetings.—Meetings shall be held when and wherever the executive committee shall direct, at least one general meeting being held each year, for receiving the annual report of the directors, election of officers, etc.

Fees.—The membership fee shall be $1 per annum. Any municipality making a grant of $10 a year to the association is entitled to name two represenatives as members.

Officers.

A president, three vice-presidents, and a secretary-treasurer shall be elected at the annual general meeting.

A board of directors of six members shall be elected at the annual meeting, to which shall be added two representatives from each individual county to be nominated by the county council; the members representing these counties in the House of Commons and the Ontario Legislature, and the Mayor or other nominee of the council of each city and incorporated town and village in these counties, provided such nominees are members of the association.

An executive committee shall deal with the affairs of the association at such times as it shall be inconvenient to call the whole directorate together. This committee shall consist of the president, the three vice-presidents, the secretary-treasurer, and two members chosen by the president and vice-presidents from the board of directors.

Newspaper Committee.

On motion of Mr. Dan. Jones, editor of the Pembroke Observer, and J. S. Crate of the Journal Newspapers, a newspaper committee was formed, the provisions being as follows:

"That the editor of each daily and weekly paper in the above counties be named a member of the newspaper committee of the association, and that the secretary notify him to that effect, and at a later date call a meeting at a convenient centre, to discuss organization, and that this meeting shall select three newspaper publishers or editors who will represent the publishers on the board of directors."

Officers of the Association.

The following is the list of officers elected: President, Ald. William Findlay, Ottawa; first vice-president—John Brennan, Arnprior; second vice-president

—Dr. T. W. Smith, Hawkesbury; third vice president—W. F. Barker, Portland; directors—C J. Foy, Perth; T. H. Moffat, Pembroke; W. F. Bell, Britannia; J. F. Ault, Winchester; D. A. McNaughton, Finch; D. E. Johnson, Ottawa; secretary-treasurer—W. Y. Dennison of Ottawa.

The executive committee consists of the president, three vice-presidents, the secretary-treasurer, C. J. Foy, and W. J. Fisher, Winchester.

Following his election as president, Ald. Findlay said he had never ben connected with any association where the response had been so generous or so widespread as in the new good roads organization. He greatly appreciated the honor, and intended to do everything in his power to advance the good work throughout the eastern part of the province.

Mr. F. Howard Annes, of Whitby, considered that the large attendance at the meeting was indicative of as great success as the most enthusiastic of them could hope for. He also pointed out that roads should be beautiful as well as useful. At the road congress in Hamilton he had proposed that, in starting out to build a system of highways in the province, great trunk roads should get as a consideration something for the future and the allotment of right of way should be commensurate with that of the steam railways. He advocated 100 ft. in width and they had gone so far as to adopt the principle of right of way of 86 ft., which would add 10 feet on either side of a 66 ft. right of way for a road. This would very greatly improve the conditions, and there would be allowance for footpaths, poles and tiles on the side of the road.

Mr. Annes also produced an interesting exhibit of the official plan of the Ottawa-Prescott road. It was a profile of a standard provincial highway, prepared by the Department of Public Highways, showing a right of way 86 ft. wide, and another right of way 66 ft. wide (it has been officially announced that the width of this highway will be 86 ft.) The plan shows 28 feet of crown, from ditch to ditch. The slopes and bottoms of the two lateral ditches occupy 8 feet each. Four feet from the top of the outside slope of the ditches are poles the one side carrying telephone and telegraph wires and the other carrying power. A four foot walk is located between the line of telephone poles and a row of trees, which have ample space for growth and spread of the limbs, there being 17 feet in all from the trees to the top of the ditch.

Mr. Geo. C. Hurdman announced during the meeting that it was the intention of the Ontario Government, he believed, to proceed with the work on the Whitney Memorial Highway as soon as possible.

An interesting suggestion was made by some of the members of the directorate of the association to the effect that the proposed road from Pointe Fortune, on the Quebec boundary, to Petawawa Military Camp should be named the "Hearst Highway." Across the border in Quebec, a scenic route through the Gatineau Hills is being planned, which is to be called the "Gouin Highway."

Following the organization meeting there was a meeting of the directors at which it was decided to arrange for a large delegation to wait on the Provincial Government and urge that the Ottawa-Petawawa, the Montreal-to-Ottawa and the Ottawa-Morrisburg roads be given recognition as provincial highways, and that steps be taken in the near future to construct them as such.

Produce and Save

THE management of the Canadian National Exhibition have distributed this year a poster entitled "Produce and Save." Production is impersonated by a maiden, "Agriculture," who is shown with graceful, powerful stride scattering the grain broadcast over the prepared land. In the background are the exhibition buildings, typical of the time and place where we are taught how best both to produce and to save. The poster draws attention to the date of the exhibition, August 26 to September 7, inclusive, and, briefly, to the most prominent features, which include 1,200 performers, a spectacle of courage and faith in "Britannia Militant," the usual varied and complex exhibits of farm products and live stock, and an unusual display of tractors and other man-power saving devices. In view of the importance of agriculture in winning the war, our national exhibition should attract more than ordinary attention this year.

Guelph Housing Association

Public-spirited citizens in Guelph, Ont., are undertaking a scheme which should go a long way towards remedying the housing situation in their city. The matter is being handled through the medium of the Guelph Housing Association, each member of which assumes the expense of erecting at least one house. These houses will be of a standard type of three designs of four, five and six rooms each. Tenders are to be called for the building of all of them as a whole, though the association does not bind itself to accept any tender and may build on their own account if they find it ncessary. The cost of building, however, must not exceed the average price obtained by tender for houses of the same size. In any case, it is to be limited to $3,600 each for detached dwellings and $2,600 for semi-detached, except in special cases, as may be determined by the committee. Each member must oversee or have overseen, the erection of his house, or houses, and every dwelling must be offered for sale at actual cost, without charge for architect's fees, supervision or interest on the principle (if house is sold within thirty days of completion) to any person who desires it for his or her sole use as a dwelling, upon the plan known as the monthly payment system. A cash payment of $100 is to be made by each purchaser, with the balance in monthly payments covering interest and payment on account of principal. The total monthly payment shall not be less than 1 per cent. on selling price of the property.

It is provided that the members shall pool their lots in each district, the selling price of the property being determined by the price similar lots in the same district may be purchased at on a cash basis. It is considered that this system of pooling the lots will reduce the cost so as to more than offset the increased cost of building.

It is argued that a new avenue will have to be opened running north from the entrance of the new Union Station in Toronto, half way between Bay and York streets, in order to provide an adequate approach to the station. Mr. C. S. Cobb, architect, has prepared a perspective showing this proposed avenue.

The Manitoba government has made arrangements to purchase 2,350 acres in the Birch River district as a site for a prison farm. The farm is to be self-developed and self supporting and the buildings will be erected by the prisoners

A Convention Devoted to the Discussion of the Housing Problem

Arguments in Favor of Concrete— Advantages and Disadvantages— Methods of Construction — Interior Design — Architectural Features

Report* of Committee on Industrial Concrete Houses

THE concrete house is now an accomplished fact. It has come to stay. For many years experiments have been made with many types. Many of the earlier houses were quite unsuitable and showed defects, but the later examples are much improved, the earlier defects are being eliminated and the concrete house as built today is a thoroughly sanitary, weatherproof, permanent and fireproof home. It approaches more nearly the ideal home than any other type of construction.

Definitions

The expression, "concrete house" is a rather indefinite term conveying different meanings to different minds. In order to make this report clear the committee have defined the concrete house as a house having external walls of monolithic concrete, precast concrete or concrete blocks. A house which also has internal partitions and floors and roof of concrete we describe as "all-concrete house." A frame building covered with stucco or gunite is not considered to fall within the definition "concrete house" and is defined as a "cement covered house."

Condensation to Be Guarded Against

We have found that there exists in the minds of the layman an impression that concrete is damp and unhealthy. It is most unfortunate that concrete should have such a reputation even though we have found some earlier houses that give some justification for this criticism. It will be recognized by members of the Institute that while a concrete wall may be perfectly waterproof it is subject to condensation on a wet day unless the walls are furred and plastered so as to get an air space insulation; this condensation is sure to be apparent. In some houses this has proved to be a very objectionable feature; in other houses inspected by members of our committee the tenants complain that on the family wash day the walls were very wet and on other days they were comfortable. Climate has a good deal to do with this.

Relative Costs

The investigations of the committee have not shown that a concrete house can be built more cheaply than a wooden frame house. The relative cost, of course, varies in different localities, according to the availability of different types of material, but speaking generally we find that the cost of a concrete house should run from 10 to 15 per cent. more than the cost of a well constructed frame house.

The advocates of the concrete house must rely upon the superior merits of concrete as a material and not upon its low first costs.

Three principal types of concrete house construction are the concrete block, the precast house and the monolithic house. We have not pushed our studies into the stucco house or cement-gun covered house, which seem to be outside of the scope of the committee. The general conclusions of the committee as to the merits of the various methods are that for small jobs the concrete block house stuccoed on the outside is the best solution, but for large developments in which more than fifty or sixty houses are required the monolithic or precast types, show an economy in cost and speed that should place them in the foreground.

Difficulties to be Overcome

In any type of concrete house construction difficulties are sure to be met with. Some of these are discouraging to the contractor entering this field and are likely to hinder its expansion unless faced and overcome. The committee have thought it well to discuss them frankly in order to guard the novice against disappointment and failure. Realizing as we do that these difficulties are incidental only and not insuperable. The successful work done is sufficient answer to any objection raised that concrete house construction is too difficult or impossible.

Precast Construction

The precast house, composed, as it is, of shop-made units of considerable size and weight, needs a large outlay on equipment for hoisting, erection and transportation of the units. This limits the use of this method to groups of houses which are large enough to amortize this outlay in a reasonable time. Great care also is needed in setting to prevent breakage—as a broken unit not only involves loss of spoiled material but considerable delay while fresh units are made. In order for a precast system to show economy the design of the houses must be alike in plan and uniform in design.

Monolithic Construction

The committee are agreed that wood forms are out of the question for monolithic house construction. Although the first cost is low the life is short, the upkeep high, and the results obtained are generally unsatisfactory. In any kind of concrete construction the concrete wall is more difficult to form than the floor, the foundations or other parts of the building, and it is therefore necessary to discard the wood form and search for something better if monolithic concrete houses are to be built successfully.

There are about a dozen metal wall forms for house construction on the market. One of these is made of structural steel channels—the rest of sheet metal. With certain forms a complete storey can be poured at one time but the greater number are designed to allow the pouring of one course (usually 2 feet) at a time.

The structural steel form has the demerit of being exceedingly heavy, but on the other hand, is easily set up true to line and giving a very good wall surface. The sheet metal form is not so easily kept true and is easily distorted and damaged, but with proper care can be used to produce excellent results.

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* Report and following papers read before the American Concrete Institute.

Extent of Application of Concrete

The committee has not come to any conclusion as to how much of the house should be built of concrete. Accordingly the members have presented their divergent views in their papers rather than attempt to come to any agreement so quickly. It is certain that the concrete wall offers great advantages due to its fireproof, weatherproof and permanent qualities. It should be furred inside. It should cost about the same as a brick wall or slightly less. A concrete floor should cost about 18 cents per square foot more than a wood floor. Concrete with wood top surface about 30 cents per square foot more.

A granolithic floor is advocated by some on account of the ease of cleaning, but for poor families who cannot afford many rugs it is unsuitable and it is unhealthy for small children to play on a cement floor.

When concrete construction is used for constructing outside features like porch columns and roofs and mouldings, cornices and ornaments the cost of the house is increased very quickly.

External Surfaces

Concrete being a new material, the tendency is generally to cover it up to make it look like something else, and therefore most of the concrete houses built up to the present time have been covered with stucco. With a steel form that gives a good even line concrete can be finished with a rubbed, or wire brushed or tooled surface that will be quite satisfactory in texture and in color. And very artistic effects can be gained with the use of colored aggregates. To finish with a wood float does not give a good result. The concrete house is superior to brick or any other type of house on account of its permanency, fireproof and weatherproof qualities and pleasing appearance. No repointing is necessary, no efflorescence disfigures its surfaces. The all-concrete house combines with these advantages the absolute rigidity which is lacking in a wood floored house, sticking of doors, settlement cracks in walls and in plastering are avoided and there is no harborage for vermin.

Restriction Laws

Building ordinances framed to control brick tile and stone construction before the extensive use of concrete in wall construction are in most cases unduly burdensome and restrictive when applied to concrete. Six-inch walls are the maximum needed in monolithic construction and 2 inches is common in precast construction where other structural members carry the load. Most codes call for 8 and some as much as 12 inches in thickness. Similar difficulties are found with floors. A reform of our building laws is urgently needed in many of our big cities and the committee has in mind the preparation of a building code for concrete small house construction which will serve as a model for cities and suggest, that afer receiving the endorsement of the Institute it be circulated and urged upon municipal authorities.

There is a widespread interest in the concrete house today. There is not, however, much active demand for them, owing to the dearth of contractors experienced in concrete work who are entering this new field to create a supply. The majority of the small houses built today are built for quick sale by the vendor and not for investment. House building standards have been low. Competition in prices has been keen but quality has been a secondary consideration. The demand at the present time seems to be for a better type of construction—concrete meets this demand.

Methods of Constructing Concrete Houses

By K. H. Talbot*

THIS paper will deal with the methods of construction, including a general resume of the types of forms which have been used in solving the housing problem. Concrete houses may be divided into the following general classification: (1) monolithic; (2) precast; (3) block. The monolithic concrete house may or may not have reinforced-concrete floors, roof and partitions, but is a residence constructed by casting concrete in place between forms. The precast unit house is made up of a number of standardized concrete units, usually manufactured at a central plant and carried to the job by proper handling equipment. Concrete floors, roof, and bearing partitions have been used extensively in this construction. The concrete block is a unit of construction which is sufficiently small to be handled by manual labor instead of by mechanical equipment. Furthermore, the units are standardized so that a number of them placed in the wall can be used for any size of house, provided the design is made to conform in overall dimensions to the size of the block used.

The same general design should be followed out regardless of the type accepted. It will therefore be assumed that the houses are to be built with large flat exterior surfaces without gingerbread, designed to accentuate the solidarity of the building material used.

The history of concrete forms for residence construction is the history of the concrete foundation. Here weight of forms was not a large factor, and ultimate economy was offset by the low cost of wood. The lumber was often used on the upper portions of the house. It remained for the large industrial development to standardize the construction of concrete foundation by the use of standardized forms, and equipment of a size which would allow their erection in a short time.

Reference should be made at this time to the forms designed by Stone & Webster for the Carnegie Steel Company in connection with 250 houses built at McDonald, Ohio. These were made up of 1-inch lumber with 2 x 4-inch studs as stiffeners. Standard panels 4 x 8 ft. were built with studs bored to allow bolts to be slipped into place to tie the panels together. The use of wire ties eliminated much of the bracing which would otherwise have been necessary. While this method of construction is admirable for foundations, and may be even cheaper than steel forms, yet the weight and clumsiness of sections are such that their application to upper storey walls of concrete houses is out of the question.

Various manufacturers attacked the problem of a proper wall form design. Among some of the more successful might be mentioned the Van Guilder, the

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* Universal Portland Cement Co., Pittsburgh, Pa.

Hydraulic Pressed Steel, the Schub, the Reichert, the Harms, the Morrill, the Blaw, and the Lambie.

The Van Guilder form, or the Van Guilder double wall machine, as it is generally known, consists basicly of four vertical plates 5 feet long by 12 or 18 inches high, held in the proper position by yokes passing over the top, the yokes in turn being connected to a lever which controls the relative location of the plates. The design is so made that either or both of the walls may be from 3 to 8 inches thick. At the top of each 18-inch course, horizontal reinforcing steel and wire ties are inserted, tying the two portions of the wall together. The character of the work done with this form is of a quality that would recommend its use where speed is not the determining factor. The fact that the form is released as soon as the concrete is tamped into place automatically determines the consistency of concrete necessary and the speed which can be made.

The Schub, Reichert, Morrill and Blaw forms, each have as the basis of design small plates, usually about 2 feet square, around the perimeter of which angles are riveted. Each system has its own method of connecting plates and holding them in proper alignment.

The Morrill form has been used successfully on operations at Nanticoke, Pa., and Virginia Highlands, Va., by casting the wall in horizontal layers at the rate of about 2 feet a day. Two sets of forms are hinged so that as soon as the concrete in the upper set has become sufficiently hard, the lower set is swung into place, and after being properly spaced is filled with concrete. These forms have also been used to cast houses in storey heights by setting up a sufficient number.

The Blaw light wall form has for its basis a plate 2 feet square, which is held by clips through the outstanding legs of the angles surrounding the plate and is lined by angles or channels. This company recommends that for industrial housing where these plates are used that they be built up into sections 2 x 8 feet, held with two stiffener angles. Sections of this size can be readily handled. They also market a concrete house form, which is made from a plate 2 feet wide and 8 feet long with proper stiffening angles.

Of entirely different design is the form manufactured by the Hydraulic Pressed Steel Company, Cleveland, Ohio, which consists of steel uprights accurately spaced 3 ft. 3 in. on centers by steel liners. Between these uprights are clamped steel plates with wood backing, the edges being protected and stiffened by steel channels onto which the clamps fit when secured. The uprights are provided with keynote slots, 6 inches on center, for keying and wedging the clamps. These are further provided with holes for wall ties 3 ft. apart. These ties consist of rods with tie clamps adjusted to any thickness of wall and serving also as separators. The uprights may be spliced together with steel splices and carried to any height.

The steel liners which space and align the uprights are secured into the keyhole slots of the uprights by keys and wedges attached to the liner. Corners are formed by means of special inside and outside uprights with end plates of special width, according to the length of the wall. The clamps may be turned in keyhole slots to admit the plates after the uprights and liners are erected and the plates may be removed in the same way, as soon as the concrete is sufficiently set, leaving the uprights to support the wall. This method has been successfully used by D. S. Humphrey at Euclid Beach Park, Cleveland, Ohio, in the construction of summer cottages.

The form manufactured by the Reichert Manufacturing Company is based on a 24-inch square unit. Special units of dimensions graded down to every two inches to a 2-inch plate permits the construction of walls of any multiple of 2 inches in length and one special 3-inch plate used in conjunction with these enables wall to be built any odd number of inches in length.

The unit consists of a galvanized iron sheet with a 1 x 1-inch angle riveted to each side, and an additional angle across the middle of the plate as a stiffener. The top and bottom angles are provided with holes opposite each other, in which spikes are dropped to maintain vertical alignment. On each of the side angles there are small pins projecting one-eighth of an inch near the top and bottom which fit into corresponding holes in the angle of the adjoining unit, thus maintaining horizontal alignment. One of the side angles has riveted to it two malleable iron clamps which hold the sides of adjoining units securely together. These units are also wired in a manner similar to wood forms, two holes being provided at each side for that purpose and stay rods, adjustable to the thickness of the wall, hold the plates apart.

A 1-inch angle with clamps riveted to it is provided for outside corners of the wall. The inside corner connection is a 2-inch angle having smaller angles riveted to the extremeties of the arms. These have clamps corresponding to those on the adjoining standard units. A hinged corner with clamps can be used for non-rectangular buildings or bay windows.

The Lambie Concrete House Corporation, Boston, Mass., have put on the market a steel form which was used in the construction of the houses at Donora, Pa. These forms consist of units of steel channel units of uniform length, depending on the height of the wall to be built, with an angle riveted across each end. The channels are provided with holes in the flanges to enable keying and wedging to adjoining channels and the angles at the ends are provided with holes for keying and wedging to a special arrangement of channels or angles at the top and bottom of the wall. Grooves are provided near the top and bottom of the units into which is fitted a steel angle which secures perfect alignment. The units are made in two standard widths of 9 and 6 inches, thus providing for any wall of a multiple of 3 inches in length.

The Harms form has as a basis of design the use of small plates, but in this case they are made of cast iron instead of steel. The same general method of holding them together applies as used for other small plate forms.

Practical Details of Using Forms

The experience with steel forms would tend to show that greatest economy can be obtained by concreting the house in one-storey lifts, sufficient forms being available to construct one storey at a time. Door openings may be either formed around, or frame bucks set in the wall, to which are attached strips which hold the door frames in place. The use of bucks and the carrying of the steel forms past window openings has been found the most economical.

Regardless of the type of forms used, floors should be cast at the same time as the walls of the storey below. Economy of construction requires the use of floor forms as supports for men while distributing the concrete for the walls.

The difference in the cost of reinforced-concrete floors and wood floors at this time is so small that I question the justifiability of putting wood floors in such construction. If wood floors are used, the joists should be placed at the time that the forming is done and in order that they may be used as braces, and to support the workmen as the house progresses. For a house 20 by 30 ft. in plan it is probable that the difference in cost would not be more than $100 per floor. To obtain that security of investment that is available only from fireproof construction, the expenditure of this amount is justified.

Economy requires that reinforcing metal in the wall be placed while forming is in progress. The usual method is to place the inside form, then the reinforcement, and follow with the outside form. This method may be reversed in erection of the basement forms. However, as a rule, the basement walls are not reinforced. The floor reinforcement must extend into the walls a sufficient distance to develop the proper bond. To meet the usual design requirement of 40 diameters embedment for bond, it will be necessary to bend down the floor bars in to thin wall construction.

Experience has shown that reinforced-concrete walls from 4 to 6 inches in thickness are sufficiently heavy for residential use, instead of the present 8 or 10-inch requirement of many building codes. It is my opinion that a 4-inch wall properly reinforced and tied to the floor level by reinforced-concrete floors is a superior construction to an 8-inch brick wall with wood joist floors.

Methods of Placing Concrete

Three methods of placing concrete have been used in the construction of monolithic houses. The first consists of elevating the concrete in buggies or wheelbarrows; the second in the erection of a tower from which the concrete is chuted into place; and the third is the system designed by D. S. Humphrey and used in the placing of concrete in his own houses at Euclid Beach Park, Cleveland, Ohio. This consists of a trough with semi-circular bottom, up which travels a series of flights on a chain, the concrete being placed in a hopper at the bottom of the trough, is elevated to the top, and distributed through chutes. The chute need not be very long, as the spout is designed as a swinging boom and is easily moved.

There are on the market small stiff-leg derricks which can be set on the corner of a house, and by which wheelbarrows or concrete carts can easily be hoisted.

When it is realized that a house, including foundation, requires not more than 100 cubic yards of concrete, it will be seen that equipment for handling concrete must be small, easily moved, and inexpensive, and that the erection of a large tower, from which at best it would be possible to chute only four or six houses is not economical.

A small mixer with a capacity of from 30 to 50 yards per day, a light stiff-leg derrick and a portable hoisting engine, preferably mounted on self-propelled trucks will give the most economical method of placing concrete. There is obviously little advantage in having a mixing equipment which will place the concrete in more than a single storey in a working day. If sufficient forms are available so that concrete is to be placed in more than one location in a day, it will be found preferable to obtain other mixing units than to double the size of the unit used.

The method of finishing the surface of the concrete will determine the quantity of spading required, and the care with which the concrete must be placed in the forms. In case it is expected to finish the surface either by floating, wire-brushing, or tooling, great care must be taken to obtain a uniform texture throughout the wall. The form must be properly oiled with a colorless material, care being taken that the oiling is done uniformly so that there will be no variation in color; the concrete must be of uniform consistency, thoroughly mixed, and carefully spaded.

It is of utmost importance that the filling of the forms be carried on in compartively small lifts, so that the layers will be placed horizontally and no water pockets will form. Otherwise, there will be sand streaks and variations in the quality of the wall surface, and in spots difficulty will be found by the appearance of laitance.

If it is planned to stucco the exterior, it will be found advisable to refrain from oiling the forms, to dry up the mix slightly, to compact it sufficiently so that there will be no large voids in the wall, but to leave the surface rather rough by reducing the spading to a minimum. If this is done more stucco will be required than if the surface were left smooth, but the added bond is worth the cost of the additional stucco.

Forms should be allowed to remain in place for as short a time as possible. This statement is the opposite of the one to which we are accustomed, but I am convinced that many houses will be built in the near future on which no stucco will be applied, but the surface of which will be treated by wire-brushing or tooling . Mr. Humphrey has shown conclusively at Cleveland that a very pleasing finish can be obtained by the use of wire brush on concrete about twenty-four hours old.

Naturally the forms on floors should be left in place for a longer time than on the walls.

Methods of Finishing Surface

A discussion of the methods of finishing the surface of the building may not be amiss at this time. Reference has already been made to three general classifications: (1) stucco; (2) wire-brushing; and (3) tooling.

Stucco has been used extensively and very satisfactorily, and has the advantage of its availability in varying colors. However, the experience of such product manufacturers as the Hydro-Stone Company and the Zagelmeyer Company leads me to believe that we can get happy color schemes by using the colored aggregates. For instance, in the vicinity of Pittsburgh, we have available a good river pebble, limestone, and crushed blast furnace slag. A combination of these with portland cement and river sand, when the aggregate is exposed, gives a very satisfactory surface. The addition of other materials, such as granite, spar, etc., can be done without greatly increasing the cost.

Two general types of stucco have been used. The first is known as patent stucco, and the second as cement stucco. The patent stucco, so called, is a manufactured article, usually having a lime or magnesium base. The cement stucco is usually made on the ground and consists of portland cement and aggregate with the possible addition of a small amount of hydrated lime.

In applying the stucco, it is essential that the concrete wall upon which it is applied be thoroughly moistened and the work protected against too rapid drying out.

The surface of many engineering structures, notably the Larimer Avenue Bridge in Pittsburgh, has been tooled, bringing out the character of the aggregate. Tooling of the whole surface of a house is expensive, and it is evident that in this type of construction where it is possible to remove wall forms early, it will be found more economical to expose the aggregate by wire-brushing.

Standardization is the basis on which the cast concrete house is to be a success, but this standardization does not mean that each house shall be just like the other, but rather that the surface and overall dimensions shall be such that the same forms can be used throughout the whole operation. The pictures of the concrete houses at Donora do not do the houses justice, in fact, a personal study of the project is required before the beauties of the houses can be appreciated. With forms which can be used successfully to meet any dimension within 3 to 8 feet, such as are manufactured by all of the form manufacturers today, there is no reason why full sway cannot be given to the architect who concentrates on large flat surfaces.

The second type of construction, usually known as precast or unit construction, or as the shop manufactured house, has been worked out by Grosvenor Atterbury, of New York City, and John T. Simpson, an architect of Newark, N.J., also by the Unit Construction Company, St. Louis, M. Basicly the methods of these three concerns are the same, although the systems of putting together the units differ.

The Simpson-Craft method consists of the use of a number of standardized units, which after being placed to proper lines are held in position by field cast connections. This applies not only to the wall slabs but as well to floor beams and floor slabs.

In the system designed by Grosvenor Atterbury, as well as that used by the Unit Construction Company in the construction of the houses for the Youngstown Sheet & Tube Company, Youngstown, Ohio, the slabs are designed so that they fit together without casting in the field. The units in this case weigh from one to twenty tons, as against a maximum weight of 750 lbs. in the Simpson-Craft construction.

The principal difference between the two methods is that the wall slab designed by the Unit Construction Company carries the floor loads directly to the foundation; while in the Simpson-Craft houses, the floor loads are transmitted through beams to girders and from them through columns and pilasters to the footings. This whole system makes possible the use of 1½ and 2-inch slabs. The minimum thickness of wall of the Unit Construction Company method is usually 6 or 8 inches.

The casting of sections at a central plant offers to the artistically inclined architect and engineer an opportunity to adopt color schemes which are not applicable to the monolithic house without the use of stucco, as in this instance the slabs can be made either face up or face down upon prepared bed plates. The Unit Construction Company has found it advisable to cast these sections on concrete forms in order that there may be no warping. Splices between sections are made by splicing the ends of reinforcing steel or by dowels fitted in sleeves in the concrete.

With proper equipment there should be no difficulty in the erection of houses at the rate of one storey a day after the units are cast, and if the number of houses make economical rapid moving equipment, it should be possible to erect one house a day with each unit.

This method of construction requires that the units be designed to fit the design of the house, and although it is possible to construct bay windows and special meatures, the added expense is not justified.

The actual cost of the precast unit method as opposed to the cost of the monolithic concrete house will depend upon the local conditions. Maximum economy is to be obtained by the construction of a large number of houses at one site. For industrial developments that take advantage of scattered vacant properties in already built-up sections of the city, the concrete block offers an economical construction.

Concrete blocks have not in the past been looked upon with favor by architects and by many engineers because of the method of manufacture in the past and the general appearance of the block. However, this objection has been done away with by the careful study of the concrete block, which is basicly a good building unit.

The houses built by the Minnesota Steel Company at Morgan Park, Duluth, Minn., have proved without a doubt that it is possible to use concrete block successfully in a large housing operation. The use of comparatively wet mixture with varied colored facing, such as granites, spar, etc., has proven very successful.

Personally I feel that the concrete block made in the ordinary machine and with a smooth face laid up in the wall with narrow unpointed joints and with a stuccoed surface is a very economical construction and one which will fulfill the needs in many places. The use of the high grade specially faced blocks without stucco is to be recommended for the very finest of residential construction. The equipment cost for concrete block is low and the number made by machine is such that it is entirely feasible to erect houses rapidly. In the construction of block houses it is desirable that the minimum thickness of bearing walls be 8 inches and that the block meet the specifications of this Institute.

Cinder concrete blocks and cinder concrete in general has been used successfully in solving the housing question. Their small weight, the availability of good cinders in most communities at reasonable prices, and their non-conductivity of air recommends them for such use. It goes without saying that any such construction should be stuccoed on the outside.

I do not believe that we have reached the ultimate economy in concrete house construction, but I do feel that the concrete houses as represented by the operation at Morgan Park, Duluth, Minnesota, Donora, Pensylvania, and East Youngstown, Ohio, have solved for all time the industrial housing problem.

Montreal Filtration Plant Operating

The Montreal civic filtration plant is now in operation—a very long time after the date of completion originally contemplated. The contract for construction passed three or four firms, while the stability of the site, from the point of bearing the superstructure, was the subject of considerable controversy on the part of two sets of engineers. The plant is capable of filtering only a portion of the water required by the city, the balance being chemically treated. There is sufficient land available for doubling the plant, but having regard to the condition of the civic finances, there is no prospect of this work being undertaken for a considerable time. In the meantime, the consumption of water continues to increase, and the question of providing means to add to the supply will have to be faced in the near future.

Advantages and Disadvantages of the Concrete House

By John E. Conzelman

IT will be necessary to define just what is meant by the term "concrete house" as it is here used. We are accustomed to speak of brick houses, stone houses or frame houses, the distinction being based on the construction used for the exterior walls. Similarly a concrete house could be classified as one with concrete walls. In such a case, the walls might be built of concrete blocks, of concrete poured in place, of unit construction, or of the plastered type of construction.

A house constructed with concrete walls of such character would have much in common with the brick or stone houses and even with the frame houses mentioned. In such a case the question of whether of not it would be advantageous to use concrete walls would resolve itself into a matter of cost, and would be settled by the local conditions governing this particular problem.

It would be impossible to dwell much on the comparative advantages of such a concrete house. There are so many other things entering into the construction of a house of this type which require attention and which affect the maintenance cost that the type of wall used will have little effect on the final analysis.

When we come, however, to a consideration of the house in which the floors as well as the walls are made of concrete we have an entirely different proposition. Such a house cannot be considered as being in the same class with the others; the introduction of concrete floors has put it into the first class. The house has in fact become fireproof and permanent, and we realize that if all or most of the houses in a community were so constructed, the fire losses from individual fires as well as those resulting from a general conflagration would be nearly eliminated.

Those who are familiar with the devastation caused by rats, mice, and other vermin that find easy lodgment in the open walls and floors of frame or brick buildings, estimate the loss in property and in the health of the inhabitants at millions of dollars annually. Practically all of this loss could be avoided by constructing verminproof concrete buildings.

We are compelled by law, in practically all of our larger cities, to build factories, hotels and apartment houses of fire resisting construction, and in the natural evolution of the thought, will surely be compelled at some time in the not far distant future to build our city houses of the same construction. As a believer in the precast or unit method of construction I can already see in my mind's eye concrete lumber yards rapidly replacing the present "wood lumber yards."

Definition of Concrete House.

The concrete house shall therefore for the purposes of this paper be considered to mean a house of fire-resisting construction with concrete walls and reinforced-concrete floors. Unimportant parts of the building, not comprised in the structural elements, may be built of other materials. For example, we would allow the wood floor finish to remain in such a house provided we cannot persuade the owner that a cement floor finish, although apparently hard and cold, is in reality a warm friend because it is sanitary and cheap.

The value of reinforced-concrete construction has been understood and appreciated for many years so far as factories, warehouses, docks and commercial structures are concerned, and the growth of this class of construction has been little short of marvelous. It would indeed be most extraordinary if the same sturdy advantages which have been demonstrated in innumerable commercial structures would not apply equally well to the construction of houses.

The question may naturally arise at this point of the argument to the effect that if the above statements are true, why have more concrete houses not been built? The answer to this question is easily given. Factories and warehouses are built by men who figure the capital invested in connection with insurance rates, maintenance charges, depreciation value and similar items and who realize that the first cost is not always the last cost. Such men realize that by adopting concrete construction they can secure a building with the best fire-resisting and weather and wear-resisting qualities, and that as a result the total capitalized investments will be less at the expiration of five, ten or twenty years than for cheaper forms of construction.

It has not been the custom to build houses on such a businesslike basis—and the first cost was usually all that was thought of. This is especially true of houses built to sell. The situation, however, is rapidly changing. Corporations and individuals are now realizing that the housing accommodations for their employees are to be considered as a legitimate part of their plant outlay. They are therefore giving to the house building problem the detailed study heretofore reserved for their industrial plants.

Under such conditions the advantages of the concrete house will be quickly comprehended and its adoption is a foregone conclusion. A manufacturer who has constructed a colony of concrete houses for his workmen rests secure in the knowledge that no fire can interfere with his production, at least so far as labor is concerned; his investment is safeguarded and if he cannot secure a low rate of insurance he will be justified in carrying it himself.

Pressing Demand for Houses.

At the present time there exists in many localities an enormous and pressing demand for houses for working men. It will be necessary to build houses by the hundreds, and in a few instances by the thousands, if the demand is to be met in the proper way. The necessity of safeguarding such large investments, whether the operation be financed by individuals, corporations or the Government, is apparent. For this very thing the concrete house fulfills the requirements of such conditions better than any other type.

We all want to know facts and figures on the upkeep charges and depreciation rates on concrete buildings and also on the usual forms of construction. It is difficult to obtain reliable data on these subjects.

Mr. Prescott F. Hall, in a paper read at the National Housing Conference, 1916, has the following to say in regard to depreciation:

"A recent canvass of 22 insurance companies, insurance agents, builders, and architects showed in their opinion an average depreciation of 1½ per cent per year for brick and 5 per cent for wood. On the cheaper class of wooden buildings, 5 per cent is probably the more correct figure.

"In February, 1915, the Lloyd-Thomas Co., which has just completed an appraisal of the city of Wilmington, Del., amounting to $73,,000,000 of assessed values, communicated to the Building Committee of the Chicago City Council the results of their findings as to the depreciation of the various classes of buildings as follows: In the better residence, the average age of the brick was nine years and the depreciation was 4 per cent, there being no depreciation in the first five years and t being 1 per cent yearly after that. In the frame the average age of the better class residence was fifteen years. The physical depreciation was 20 per cent. and the obsolescence 10 per cent. Obsolescence is partly due to going out of style and this is due largely to lack of architectural planning. The total depreciation was 30 per cent. In the middle class residence, the average age of brick and frame were the same, fifteen years, and the total depreciation of the brick was 20 per cent and the frame 45 per cent or two and one-fourth greater in the frame."

Concrete Depreciation Negligible.

You will see that no data is given for concrete construction. However, the rate of depreciation for brick is given at 1½ per cent per year. This is a low rate and we know that the rate for concrete must be considerably less than for brick and wood construction. If it is much less, it will be a negligible factor. We will have to take upkeep, or repair charges into consideration if we are to give concrete its proper due. Here again we must admit that we have practically no reliable data on upkeep charges, but will have to use our reasoning faculties to arrive at any result.

We are told by the cement manufacturers that "concrete is permanent" and those of us who have engaged in making concrete for many years know that this statement is true, provided suitable materials have been used and that these have been mixed long and well and in the right proportions.

Well-burned bricks are also permanent—perhaps not so permanent as concrete, but still sufficiently permanent to be considered so for all practical purposes. It is not in the walls therefore that we will find any great advantage for concrete construction. When we come to the consideration of the exterior woodwork, such as porch floors, railings and posts, to say nothing of steps, the advantage of concrete construction becomes very apparent. It is such items as these that make the upkeep of ordinary construction so high.

In a reinforced-concrete house the floors and vertical supports are rigid and unyielding and so do not shrink, As a result there is little cracking of plastering and settling of floors, resulting in loose trim and sticking doors in a concrete house. These are the items that call for continual repairs and which are eliminated from the upkeep charges of a concrete house. In some types of concrete houses the plastering can be omitted entirely.

In a consideration of depreciation and upkeep charges, it must be borne in mind that certain items which total a large part of the cost are common to both the concrete and ordinary constructed house. I mean such items as plumbing, heating and lighting fixtures, roof covering and hardware, and many others of a similar nature. These items will have practically the same depreciation in a concrete house that will exist in a brick or frame house and must therefore not be considered in a comparison of values.

It has been stated that the average economic life of a house—by which is meant its period of usefulness for the purpose for which it is built—will not exceed 35 or 40 years in most American cities. It is therefore seen that we will have to make some effort to extend this period of economical life if we are to make full use of longer possible life of the concrete house.

60 to 80 Years..

Such effort cannot be applied to the individual house but must be a broad movement affecting the entire neighborhood, if not the entire city. For lasting success, city planning and districting must come to the rescue and stabilize conditions and values. It should be possible, by such means, to prolong the economic life to 60 or 80 years, perhaps even indefinitely as has occurred in numerous European cities. If the economic life were doubled, enormous savings to the country would result.

Any discussion on the advantage of fire-resisting construction would be incomplete without taking into account comparative fire insurance rates. Mr. Grosvenor Atterbury, architect, has given some information on insurance rates on different types of residences now in force in the locality of Forest Hills, Long Island. He states that the ordinary rate in the vicinity of Forest Hills varies from 40 c. per hundred dollars value on brick houses to 60 c. on frame dwellings. The rates given covering a period of three years.

The houses in Forest Hills Gardens, as you no doubt know, were built by the Sage Foundation Homes Co. and this development comprises a group of most modern and substantially built houses. Most of these houses are of special construction with masonry walls and tile roofs. Metal lath is used throughout and all vertical supports are of metal or masonry. On this type of house the rate is 25 c. per hundred. Among these houses are several groups of concrete houses built under Mr. Atterbury's method of precast construction. These houses have cellular walls, reinforced-concrete floors and roofs, and may be classed as really fireproof construction. These houses receive a rate of 20 c. per hundred dollars valuation.

Building Codes Need Revision.

The building codes of practically all cities are so framed that they practically discriminate against this form of construction. Instead of fostering the construction of fireproof houses, these laws have exactly the opposite effect. An example will best illustrate this point. The company with which I am connected is now constructing some concrete houses on Long Island. The floor slabs were of such size and design that a slab 2 ins. thick would have been entirely satisfactory from an engineering standpoint. The building code required a minimum thickness of 4 ins. for all floor slabs. In this particular case the structural concrete is to be topped with a layer of nailing concrete 1½ in. thick, on top of which the wood finish is to be nailed. Had these houses been built with wood joist and flooring a single thickness of floor would have been sufficient. However, as the floor slab was concrete, it was decided that in addition to the wood floor just mentioned there would be required 5½ in. of concrete. Such excessive use of materials seriously handicap fireproof construction.

It is obvious that such inconsistencies must be remedied when the properties and advantages of such construction become more generally understood.

There are many of us who believe that houses should be built of standardized sections, just like automobiles. These sections would be made in factories under the most economical conditions of manufacture, and houses would be carried in stock just like other manufactured products. When we get to this stage of progress it will be possible to erect the walls and floors of a house in one day, or at the most, two days, and at a great saving in cost.

Lends to Standard Construction.

Concrete lends itself admirably to such standardized construction and its fire-resisting properties and other features give it distinct advantages over all other building materials for this class of work.

In order to bring the rent or selling price of a house within the means of the poorer paid workingman, it is necessary to avail ourselves of all possible economies in the design and construction. Even if we limit the conveniences to the minimum compatible with proper living, it is practically impossible to bring down the cost of a detached house to a point where such workmen can afford to live in them.

We can meet this condition, however, if we build the houses in groups or terraces; or at least, if we cannot meet it, we know that such construction is the cheapest that can be built. One great objection to building rows of houses of ordinary construction is the fire risk. Another vital objection is the possible spread of vermin. By building of fireproof concrete construction, we can overcome both of these objections and help a long way toward the solution of the housing problem.

It is impossible for any one who has studied the concrete house proposition to dwell very strongly on the disadvantages of this kind of house. The advantages so far outweigh the disadvantages that one is inclined to talk of them and let the disadvantages take care of themselves. And this is eminently the proper course to pursue because the difficulties and disadvantages of the concrete house are all due to the newness of this form of house construction, and will be worked out in actual practice.

Architectural Treatment.

We have not yet evolved standard principles of architectural treament that can be applied to concrete houses and produce pleasing effects. The ordinary architect is familiar with brick and wood construction and uses these materials easily, and in time a special form of treatment for concrete houses will be developed. It is evident that the tendency will be toward simple and straightforward designs because the requirements of the construction demand it. If we develop the architectural treatement along simple, wholesome lines with regard to securing effects by proportions of surfaces, we will have advanced the architecture of the workmen's house considerably.

Untreated concrete surfaces do not as a rule present a pleasing appearance, and most of us object to the monotony of such a surface. This condition is aggravated after a rain. It is possible to overcome this disadvantage by some sort of surface treatment without excessive cost.

It is often said that concrete houses are damp and this opinion is generally held by the layman. We all know that the concrete block house was responsible for this thought and that the methods of construction now in use will overcome this trouble. We should not blame any material for defects caused by its misuse, and a well constructed concrete house is as dry as any other.

It is possible to build houses of concrete, houses that are fireproof, vermin proof, entirely comfortable and wholesome, houses that are practically permanent and have a negligible upkeep cost, and it is possible to do this at a price that makes the proposition an economical one from the purely business standpoint.

Why then should we hesitate to adopt such construction? The advantages, even in the present state of the art so far outweigh the disadvantages as to make the latter negligible.

Interior Construction of the Concrete Industrial House

By M. D. Morrill

IN the consideration of the best interior construction for industrial houses, let us take for example these built and owned by a manufacturing or holding company to be rented by the families of the employees.

These houses must be expected to stand hard service. They will be occupied by one family after another and moving furniture is hard on the house interior. There will be some large families with several children and many with three or four lodgers. Experience shows that some of these families will keep their houses spotlessly clean while others will be indifferent as to dirt, insects, fire risks, and care of the house generally.

The interior of the industrial house should fulfill the following requirements:

(1) The rooms should be light and cheerful, free from dampness, warm in winter and cool in summer.

(2) Such a house interior should be free from dust-catching woodwork.

The surface and finish should be as waterproof as possible so that the house may be washed out, scrubbed and thoroughly cleaned between rentals.

(3) In the construction, cracks, crvices and concealed spaces should be avoided, as they are likely to harbor and offer a breeding place for vermin and insects.

(4) The construction should be fire resisting or, better, fireproof.

(5) The construction should be reasonable in first cost, permanent and capable of resisting hard usage with a minimum expense for upkeep and repair.

Let us consider three of the possible types of interior construction for industrial houses: (1) A house with masonry walls, the usual wood floor beams, board floors, lath and plaster ceilings, wood stud partitions lathed and plastered; a nonfireproof construction. (2) A house with masonry walls, reinforced concrete floor slab covered with wood sleepers and board floor, bearing partitions of concrete or tile; fireproof. (3) A house with a concrete floor and cement finish partitions concrete or tile;

The first type of construction is the least expensive in first cost and has the advantage of being the kind to which we are all accustomed. An interior of this kind with wooden floors, door casings, base and window trim seems the most comfortable and home-like. We would like to stop here and forget that most disastrous fires gain their headway in the open spaces and dry timbers of these wooden floors. We would also like to forget that these concealed spaces in the partitions and floors form ideal breeding places for insects and vermin. A house interior of this construction can never be completely cleaned. One untidy or careless tenant can ruin such a house. What is worse, through the neglect of proper precautions in case of tuberculosis, for instance, he might imperil the health of future tenants.

The second type of construction is an improvement over the first. The fire hazard is eliminated by the concrete floor slab. The wooden floors laid over the concrete give the house a familiar and home-like aspect. For the industrial house this type of construction has the disadvantage of being the most expensive.

The third type is a house with a concrete interior. Such a house can be made sanitary to a degree. There are no hidden spaces in the construction, therefore insects must live in the open if they live at all. On a trip of inspection to Nanticoke, Pa., the writer saw one of these concrete houses being scrubbed from top to bottom in preparation for a new tenant. After occupancy for many years these houses will be in good condition and soap and water will make them fresh and clean again the same as it does to-day.

The house with a concrete interior has the further advantage of permanency and capacity to withstand hard usage. The expense of upkeep and repair therefore is reduced to a minimum and depreciation becomes almost nil except on the doors, windows, plumbing fixtures, etc. Fire insurance becomes unnecessary, as there is little or nothing about such houses to burn.

On the other hand, there are objections to the house with the usual concrete interior. During the past five years the writer has had the opportunity to inspect in all 83 houses with concrete interiors. It may be of interest to note here this list:

12 dwellings built under the Small-Harms patent in Paris, France.

8 houses built under the Roughsledge system for the Canadian Cement Co. near Montreal, Canada.

20 dwellings at Gary, Ind., for American Steel & Wire Co.

40 dwellings at Nanticoke, Pa., for the D. L. & W. R. R. Co.

1 house at Brentwood, Md.

1 house at Virginia Highlands, Va.

1 house at Union Hill, N.J., built under Mr. Simpson's plan.

The interior appearance of the majority of these dwellings is crude and unfinished, while from a structural standpoint the superiority is very marked. The question therefore arises, how may the interior appearance of the concrete house be so improved as to make it more attractive and comfortable?

Let us look into the possible changes that might be made in the finishing of the interior of a concrete house and see if some of the objections and faults cannot be overcome. We must remember that the art is new and that most of the useful things about us were not in their first stages the beautiful articles that they are to-day. One error that some of us have heretofore made is in trying to produce such houses at too low a cost. In the interior treatment just as in the exterior construction we can afford to go to more expense than is usual in the ordinary house, for the building is for all time. It is almost an axiom that the permanent building is the low-cost building in the long run and a concrete house with a concrete interior should with a minimum of repairs give service for a long period of years.

The cement floors have perhaps been considered as the greatest drawbacks in the fireproof house. There is no denying the fact that the cement floor without rugs or matting is a hard surface upon which to live; however, most of our modern hotels and office buildings as well as the modern tenements are now using cement floors and no serious complaint is made after the tenant has become accustomed to them.

If the cement floor could be given a more attractive finish, prejudice against it might be overcome to some extent. Such floors might be finished with a terrazzo surface, and at a cost that is not excessive where machine grinding can be employed, or the floor may be finished with a surface of white portland cement and marble dust. A floor of this sort can be waxed and polished much the same as a wooden floor. In some of Mr. Simpson's plans he proposes using a cove base of hard wood which is let in flush with the cement. This would serve as a tacking strip for carpets if such are desired.

The treatment of the interior walls of the concrete house does not differ materially from houses of other construction. For industrial houses it is generally conceded that painting is the most sanitary and satisfactory finish for the walls. The usual wood trim or casing around the windows and doors may be used, or if desired this can be altogether omitted, the plaster returned with a slightly rounded corner, making a simple and sanitary finish.

In the industrial house, built-in fixtures and cupboards should be bracketed from the walls where possible, as this leaves the floor space clear for ease in sweeping and cleaning. Curved corners where walls meet and at the base and ceiling help in cleaning also. In time the wash-tub, bath-tub and kitchen sink for the industrial house will without doubt be molded in concrete, but at the present stage of the art enameled iron is a far better and less expensive material to use for these fixtures.

In the house with a concrete interior the stairs may be of the same material. The risers and treads can be precast and set in place. The stair railing can be made likewise. Where cost permits, decorative tile or precast panels may be set in the house walls, stencilling makes also an attractive way to apply simple decoration.

At the recent joint conference of the Union of Canadian Municipalities and the Civic Improvement League in Victoria, B.C., a resolution was passed favoring the general principle of each province having adequate powers to prepare comprehensive town planning schemes, to regulate housing developments, and to secure improved sanitary conditions, conveniences for traffic, and the economic use of land for all purposes.

Extensive alterations are under way to the pumping station at St. Mary's, Ont., where all the steam apparatus is being scrapped. A large reservoir will be constructed in the room of the power house which now contains the boilers, for fire protection.

Architectural Design of the Concrete House

By E. G. Perrot

WITH the growing importance of the necessity for permanent construction of good homes for the wage-earner is the all important one of materials for construction coupled with successful architectural design.

When viewing the successful creations of the small house for the wage-earner which found its early expression in modern industrial villages planned on Garden City lines, financed and built by industrial establishments, in England, notably at Port Sunlight, Bourneville and Letchworth, we are surprised to find the high character of the architectural treatment of these houses. Their coziness and real homelike effect contrasts very strongly with our company houses in the United States which will ever remain as one of the blots on the architectural horizon since the opportunity to combine the utilarian with the aesthetic has been, it would appear, almost studiously avoided when it would have been possible, with a little care and study. to have approached nearer to that which we are now striving to attain, namely, cheap artistic homes for the wage-earner.

Concrete as a building material, having been used mostly in its early application to building construction and engineering work, has been left to the chaotic caprice of the uninitiated in the realms of fine arts to be developed more in a structural manner than has been good for the effect on the public at large. This has been so much so that the architectural profession has concerned itself less with the ornamental treatment of concrete than with its structural importance.

Good architectural design is based on unity, grace and proportion. It is by the adaptation of the first and last of these fundamental qualities that concrete can simulate a design which might be suitable for any other material of a plastic nature, such as stucco on brick or hollow-tile, or of even simple types of brick buildings.

Many of our present types of domestic architecture lend themselves, with very little modification, to reinforced concrete.

In the treatment of the exterior design, a style that depends upon plain wall surfaces with well proportioned and properly related openings, with the avoidance of projecting moldings, useless and meaningless ornamentations, etc., is the one which can easily be executed in concrete. It is very essential to studiously avoid molded forming string courses and projections. Flat bands forming string courses and panels may be judiciously used when the style of architecture demands such treatment.

Whether the roofs are to be flat or high-pitched depends generally upon the climatic conditions of the locality in which the houses are to be built. We all know that the pitched roof in color lends very much to the attractiveness of a house. A low walled and high roofed house more easily produces the effect of the house being a part of the ground, or in other words, as growing out of the ground instead of simply standing upon it. This feature of making the architecture indigenous to the soil is the one which, more than any other, is so characteristic of the many beautiful industrial villages seen in England.

It has been found to be more economical in the cost of construction to build houses in groups or rows, limiting them to rows not exceeding eight of ten, than to build single or twin houses. A great many varied effects can be obtained in the group system by the use of projecting pavilions, gables, etc.

One feature that should be given consideration in the exterior of the concrete house is its color. The unattractive mouse color of concrete cannot be made to satisfy the color instinct in man. It is for this reason that the poured concrete house, unless treated with a special aggregate or other means to enliven the color, is bound to be a failure.

Where an extensive housing programme is contemplated, one method of using concrete which permits of beautiful color effects as well as artistic design is by the cement-gun. It appears that much can be gained by a study of how the gun can be brought into more universal use in house building. In connection with stucco work along the Pacific Coast it has been very successfully employed, while in the East its use in connection with engineering structures has, of late, been brought into great prominence. There is still a big field for its application in connection with houses, which the writer feels will solve many of the complications of the problem.

The use of concrete blocks for houses is restricted to certain sizes and shapes of blocks, and, although made to imitate natural material, stone, their use is unartistic from the purely architectural point of view, and for that reason have not been adopted by architects generally. Walls built of rough concrete blocks, however, can be stuccoed with hand-placed mortar. Tile inserts, properly placed, make a very effective design, especially if the colored tiles are judiciously used on piers, panels and in string courses.

Monolithic concrete walls can best be colored by using colored aggregates, surface scrubbed, thereby removing the outer film and leaving the colored aggregates exposed to view. If it is possible to do this, the wall can be tool-dressed with a pneumatic tool after the concrete has hardened. From the writer's experience, a light pebble forming the fine and course aggregate in the concrete, with a scrubbed or tooled finish, makes an excellent exterior for poured monolithic walls. However, as this material is not available in all localities, it is necessary to adopt a treatment of the exterior that can be obtained by materials at hand, using tile inserts as previously mentioned above.

Therefore, if we are to look for a solution of the architectural expression of the concrete house, we must get away from what has hitherto been satisfactory from a purely engineering standpoint. We must remember that a house, in order to be successful, must simulate the home spirit and, if I may use the term, have a little of that quaintness which is not found in a great many "stiff" creations parading under the name of houses. Many are merely wooden or concrete boxes.

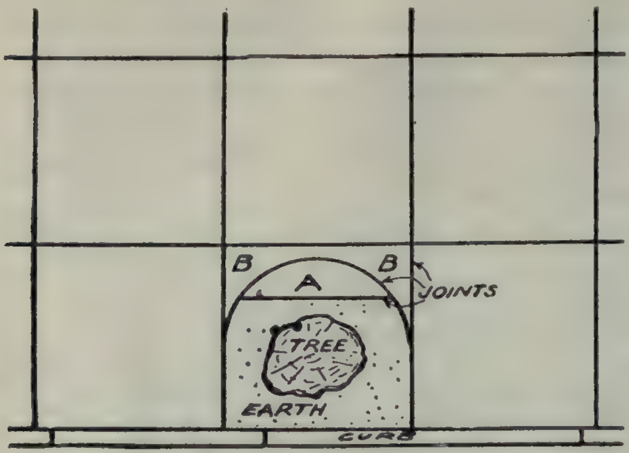
I realize that what I have said may not be very encouraging to those whose efforts have been put forth to advance concrete house construction, but if we are to place this construction in the class of other materials which have long since been recognized and used by all peoples as meeting aesthetic demands, we will have to adopt the same fundamental principles which form the basis of all true art.

Practical Hints for the Contractor

that may save him time and money. If you know any labor-saving scheme, send it in—preferably with illustrations. We will pay for all accepted articles.

Sidewalk Joints Around Trees Prevent Cracking

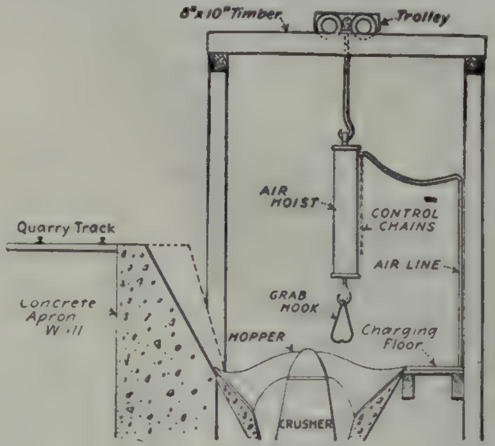
Where it is necessary to build concrete sidewalks in the vicinity of a row of trees, without disturbing the growth of same, as well as to guard against possible cracking of the concrete, a method of making joints near the tree base, shown in the cut, has been used in New York with good results. As the tree trunk grows in size, the section A is removed by hand—or the roots themselves raise it—and still later, if necessary, the section B may be removed. The joints at each of these sections allow this to be done without cracking or disturbing the adjoining slabs of the sidewalk. The joints may be conveniently formed of one or two thicknesses of tar-paper. This completely prevents any bond between sections A and B and the balance of the sidewalk.



Removing Lodged Spalls from Crusher Bowl

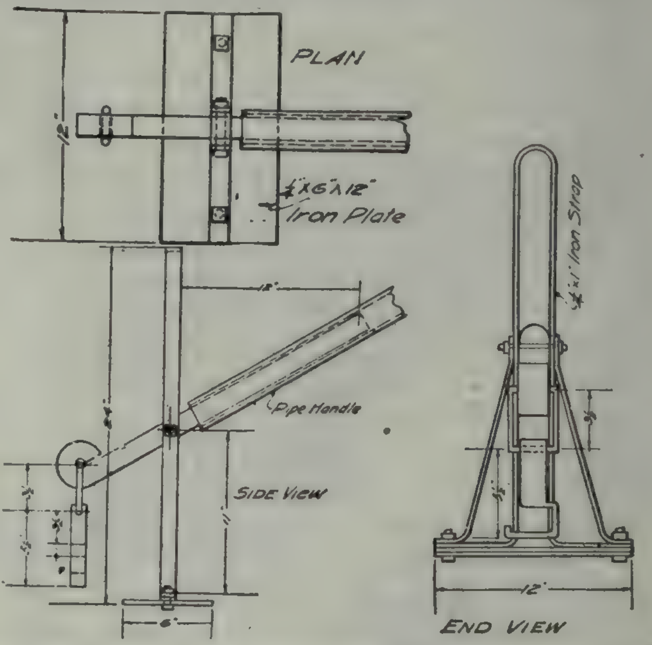
THE usual main strength method of removing the annoying spall, in a crusher bowl, has been replaced, in certain cases, by an air hoist, as described in a recent issue of the "News-Record." In one case where this method is used, the cars loaded with rock come in from the quarry on a track about 6 ft. above the charging floor. The stone from these cars is dumped into the hopper over a large concrete apron built for the purpose. Two 8 x 10-in. timbers on edge, secured to the frame of the building, carry a four-wheeled dolly truck over the centre of the hopper. Suspended from the truck by a hooked bar is a medium-sized cylinder air hoist fitted with the usual air control chains, and connected to a convenient air line. A set of grab hooks designed for the handling of large irregular pieces of rock is attached to the hook end of the piston.

Under ordinary running conditions the air hoist and the trolley are easily pushed to one side, but when a large spall lodges between the supporting bridge and the sides of the hopper, or when it is necessary to raise a large piece of rock clear of the hopper, the hoist is swung out and the spall is removed without loss of time.



A Pin Pulling Device for Paving Contractors

In order to speedily remove form stakes after the work is completed, especially if the job is a big one, the appliance shown has been used with good success on a highway in Ohio, according to the Concrete Highway Magazine. The device consists of a lever supported near one end in a frame where it is made to pivot on a pin. On the end of the lever is a hook which engages the top of the pin to be pulled, downward pressure on the long section of the lever, causes this to clamp on the top of the stake and additional pressure pulls it out.



Increased Charges for Street Repairs

The Administrative Commissioners of Montreal recently decided to increase the charges to the public utility companies for repairing the streets after the companies excavated the thoroughfares for the purpose of repairing breaks, etc. The Commissioners have now issued a new schedule of charges, to cover the higher costs of the work. The charges will be: For asphalt paving and bitulithic, laid on a six-inch concrete foundation, $5 a square yard; the same on a nine-inch foundation, $6 a yard; for asphalt macadam $5 a square yard; for granite, asphalt and scoria blocks, vitrified bricks on six-inch foundation, $7.70 a square yard; the same on a nine-inch foundation, $8.50 a square yard; the same on a nine-inch foundation, $8.50 a square yard; asphalt macadam, tarvia and asphalt blocks without foundation, $3.50 a square yard; ordinary macadam, $2.50 a square yard; unmade roads, $1.50 a square yard. Regarding cuts made in sidewalks, the commissioners have also prepared rates, which are $4 a square yard for cement and asphalt, $3 for flags and coal tar, and $2.50 for cement blocks without foundation. The cost of renewing cement curbs is $1.50 a running foot, and $1 a foot for stone curbs.

It has been found that the minimum air supply that a man can breathe and work under is 1.5 cubic feet per minute. Thus the fundamental formula of air supply for divers is $S=1.5\ (1+F.0303)$, where S is the cubic feet of air required, and F the depth in feet to which the dive is to be made. The depth to which a diver may go is limited by the fact that oxygen under pressure becomes a poison when breathed. The real danger due to oxygen pressure is at about 10 atmospheres pressure absolute, or 297ft. for appreciable periods. This increases with the depth, and at fifteen atmospheres absolute pressure even the shortest stay would be dangerous.

On account of the past unsatisfactory method of employing civic help in Vancouver, the city council have empowered City Engineer F. L. Fellowes to hire all employees and to fix their pay. In addition he is made the last court of appeal in such civic matters, and all restrictions which heretofore prevailed in regard to preference being given taxpayers and married residents are off. The only question that is supposed to count now is efficiency in the matter of engaging men and holding their jobs.

The following have been appointed a special committee of the Montreal Builders' Exchange to make all arrangements for the proposed conference of the various Builders' Exchanges and other contracting interests on present and after the war problems—Messrs. John Quinlan, J. P. Anglin, R. F. Dykes, W. M. Irving, C. F. Smallpiece, W. C. Munn, W. E. Ramsay, and D. K. Trotter (secretary).

The Brockville and Prescott toll road is to be purchased by the local municipalities and the provincial government, the price being $9,000. The townships of Augusta and Elizabethtown will pay 30 per cent of this amount, the towns of Brockville and Prescott, 30 per cent., and the Ontario government, the remaining 40 per cent.

Mainly Constructional

East and West—From Coast to Coast

The Boundary Bay Oil Company, Limited, has been incorporated, capital $500,000, head office Vancouver, B.C.

The Gamble Mining Company, Limited, has been incorporated, with a capital of $25,000, head office at Kimberley, B.C.

The Lee Copper Mining Company, Limited, has been incorporated, with a capital of $75,000, head office at Vananda, Texada Island, B.C.

The city of Stratford, Ont., has sold its filters—three to New Toronto and three to Weston—and is supplying well water to the citizens.

Seven grain elevators have been completed this year by the Saskatchewan Co-operative Elevator Company, and work is proceeding on four others.

Peacock Bros., 285 Beaver Hall Hill, Montreal, have a unique service station for repairing measuring instruments, with a testing and calibration branch.

Talc Products, Limited, has been incorporated with a capital of $10,000, head office at Vancouver, B.C. The company is authorized to operate talc mines.

The water mains in that part of York township adjacent to Eglinton Ave., which is to be supplied with water from the city of Toronto, have been completed.

Many of the offices in the city hall in Hamilton, Ont., are said to be congested and the council contemplate its enlargement by the erection of an annex.

Canadian Refractories, Limited, has been incorporated, with a capital of $20,000, head office Montreal, and will carry on the business of manufacturing bricks, etc.

The building permits issued for residences in Toronto during the month of June exceeded in number those issued in any month for the past two years and a half.

A deputation recently waited on Hon. Geo. Grierson, Provincial Minister of Public Works, to request the erection of a bridge across the Assiniboine river at Headingly.

One complete new building, 50 x 50 ft., and an extension to the old plant, 50 x 32 ft., are being added to the plant of the Ingersoll Machine Company at Ingersoll, Ont.

Work is now under way on the Wellington street bridge near Victoria Park, in Woodstock, Ont. It is understood that the contract called for its completion in sixty days.

The Sherbrooke Business Corporation, Limited, a recently incorporated company with a capitalization of $49,000, is authorized to carry out building operations, paving, etc.

Merritton, Ont., has been incorporated as a town. The occasion of this important step was Dominion Day, when a celebration was held and a tablet unveiled to commemorate the event.

As no tenders were put in for the retaining walls and end walls of the St. Boniface approach of the new Provencher bridge, connecting Winnipeg and St. Boniface, Engineer Sedlack has been directed to proceed with this work by day labor.

Three million dollars have been set aside by the government as an appropriation for good roads in the district around Hearst, Ont., and in the vicinity of Kapuskasing, in order to facilitate travel for the settlers in the north country.

The Merchants Bank of Canada propose to erect an office building at 16 King St. West, Toronto. It is understood that work will be carried out later in the season on a handsome structure, three storeys in height, and that it will be ready for occupation early next winter.

The building permits issued in Kingston, Ont., during the first half of the year are almost double those of the corresponding period in 1917, the figures being $134,000 and $76,000, respectively. The permits for the month of June are also far above those of the same month last year.

A building, 200 ft. x 60 ft., to house the Military Mechanical Transport section, will be built in Toronto on a site just to the south of the Armories, tenders already having been received. It is to be completed by the fall, the erection being supervised by the Department of Public Works.

At a recent meeting of representatives of the town of Burlington, Ont., and the counties of Halton, Wentworth and Lincoln, a resolution was passed to petition the provincial government to contribute to the upkeep and building of the road that skirts the lake between Burlington and Stoney Creek.

Work is being pushed forward on the plant of W. Harris & Company, Limited, in the new industrial district in Toronto, the excavation work and the sheet steel retaining wall on the river front being completed. Railway sidings are also being rushed to completion, and a contract has been awarded for a 157-foot chimney.

The Railway Board has issued an order authorizing the construction of a double subway under the C. P. R. and G. T. R. tracks at Dorval, P.Q. Twenty per cent. of the cost will be paid out of the level crossing fund, and of the balance the railways will pay fifty per cent., Dorval municipality 35 per cent., and Dorval parish, 15 per cent.

Messrs. McPhail and Wright Construction Company, of Sault Ste. Marie, Ont., have been awarded a contract by the Canadian Copper Company, for the erection of fifty houses at Copper Cliff. These houses will cost over $4,000 each and will be of frame construction. They will be equipped with modern conveniences. Twenty-two of them are to be put up immediately.

The county municipality of St. John has appointed a committee to confer with the town planning commission of the city of St. John. A conference between the committee, the commission and the Town Planning Adviser of the Commission of Conservation was held some weeks ago and considerable progress is being made towards the development of a suitable scheme.

The Hamilton, Ont., board of education recommend the erection of a new 24-room school, one-storey in height, on the National Children's Home property, at an estimated cost of some $200,000. The one-storey type of school is an innovation in Hamilton and has been decided upon following the board's visit to Rochester. Another feature of the building will be the provision of an auditorium.

Continued dry weather is reducing the flow in Capilano and Seymour creeks, from which the city of Vancouver draws its water supply, and may affect the quantity of water received at the intakes, and it is planned to immediately construct a concrete dam on the Capilano. This will take the place permanently of the sandbag dams constructed in other years and swept away each succeeding high water.

Nearly one hundred miles of railway will be laid in Saskatchewan in connection with the C.N.R., as a result of the recent authorization by the Dominion government of $7,185,300 for construction and betterment work on various parts of the system throughout Canada. There is to be a 43-mile extension from Eston to the Alberta boundary line, also extensions to the Luce Lake branch and the branch from Avonlea to Gravelbourg.

The water supply at Moose Jaw, Sask., is inadequate to meet the requirements of the population, and in order to increase it sufficiently, it is proposed to lay a cast iron pipe to Snowdy Springs. A by-law covering this scheme is to be submitted to the people and in the meantime the commissioners will seek the permission of the Bureau of Public Health. The present supply is drawn from Caron, and whether any greater quantity could be obtained from that source is doubtful, as it would depend on the rainfall and the spring freshets occurring afterwards. The flow at Snowdy Springs is about 150 gallons per day.

The proposed dry-dock at St. John, N.B., will be the largest on the continent and will be capable of accommodating the greatest ships of any navy and the largest mercantile vessels now built or contemplated. Its length will be 1,150 ft., and its width at the bottom, 125 ft., with 40 feet of water over the sills. The enterprise is in the hands of the Canadian Dredging Co., Midland, Ont., which has acquired the stock of the St. John Drydock & Shipbuilding Company. It is expected that steel shipbuilding will form an important part of the undertaking, if present plans materialize, and that keels for two 10,000-ton vessels will be laid within the next year or year and a half. The work on the new drydock and certain dredging operations in the harbour of St. John which the company has contracted for, will, it is expected, be started within sixty days and both should be completed within three years. The contracts call for an expenditure of close upon ten million dollars.

Personals

Mr. E. A. James, engineer of York county, has been elected District Deputy Grand Master of Toronto Centre District of the Masonic Order.

Mr. J. P. A. Laforest, for many years city engineer of Hull, P.Q., is now in South America with the Braden Copper Co., Rancagna, Chili, having left Canada a couple of months ago.

Mr. Edw. J. Albert, for the past five years manager of the Mining and Power Department of the Canadian Allis-Chalmers, Ltd., has resigned, to accept a position as sales manager of the Thwing Instrument Co., Philadelphia, Pa.

Mr. E. W. Pattison has resigned his position as municipal engineer of Langley, B.C., and is leaving for the east. Mr. Pattison has only held the position for three weeks, having been appointed in succession to Mr. Verner.

Edwin C. Brooks, a prominent building contractor of Fernie, B.C., left early in June for the Coast, having been called up under the Military Service Act. Mr. Brooks went to Fernie from the Old Country nine years ago and built up a very nice business. He has two brothers who are also serving under the colors.

Obituary

Lieut. George M. Scott has been killed in action whilst serving with the 62nd Wing Aegean group. He was a graduate of McGill University.

Mr. Henry Carre, B.A., D.L.S., O.L.S., who was identified with railway engineering in the early days, died on July 11 at Belleville, Ont., aged 85.

Ex-Alderman Wm. Hancock, formerly a well-known building contractor and brick manufacturer, of Hamilton, Ont., died recently. He was in his eighty-fifth year, and had retired from business ten years ago.

Mr. Eugene Patrick Quirk, C.E., died in Montreal last week. A graduate of Trinity College, Dublin, Mr. Quirk came to this country in 1874, and was engaged on harbour and railway work, chiefly in Eastern Canada. He retired from practice 15 years ago.

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A Case in Which it is No Honor to Be in First Place

A REPORT just issued by the Commission of Conservation on the fire waste of Canada shows us up in a very unenviable light. The fact is that **our fire loss, per capita, is the greatest in the world,** amounting to approximately $3.00. This is a big load for every man, woman and child to carry and seems all the heavier because it is unnecessary and unreasonable.

Of course it is useless to argue that this loss is borne by the insurance companies. It all comes out of the people directly out of those who pay premiums and indirectly out of those who do not, for fire means a national loss which is shared by all. And the property loss is not all—there is the inconvenience, the loss of business, of revenue, of wages—all clogs in the wheels of our national industries. And to think that much, very much, of this is due to sheer carelessness! The report summarizes the results of the Commission's investigations and offers recommendations for remedying the unsatisfactory conditions:

General Conclusions.

1. That the annual loss of life and property by fire in Canada—the latter averaging $2.73 per capita annually for the years 1912-1915 is greater per capita than in any other country in the world, and constitutes an enormous and increasing drain upon the resources of the Dominion, besides most seriously affecting the economic prosperity and general well being of the people.

2. That such losses can be very materially reduced. This is clearly shown by the experience of European countries which have attacked the problem at its source.

3. That the loss by fire is chiefly ascribable to
   (a) Carelessness due largely from a sense of security created by the present system of fire insurance.
   (b) Faulty building construction.
   (c) Arson.
   (d) Lack of adequate fire prevention, such laws as exist being poorly enforced.

4. That, for immunity from the danger of fire losses, the people of Canada are relying largely upon elaborate and expensive systems of fire fighting and are giving too little attention to the prevention of fire.

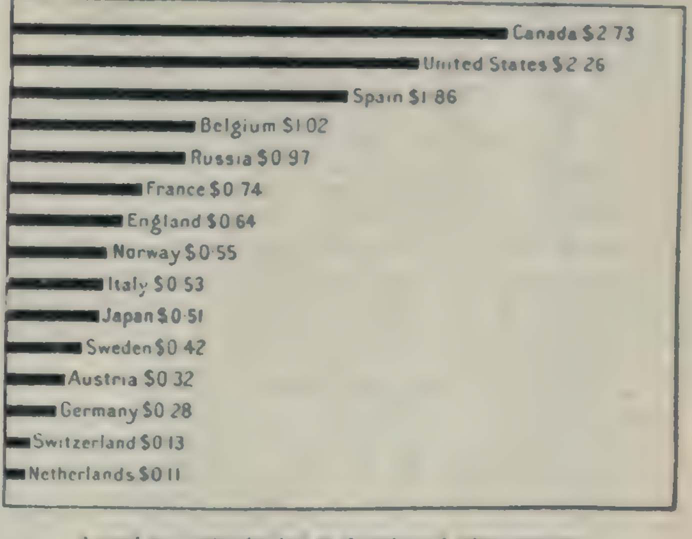
5. That our fire departments, while among the best in the world in both apparatus and personnel, are not preventing the steady growth of losses.

6. That the monetary indemnity provided by fire insurance does not restore the values destroyed, but merely distributes the loss, through the channels of commerce, over the whole people.

7. That the cost of fire insurance and fire prevention is, in a large measure, determined by the amount of the fire loss and cannot be expected to decrease except as the fire waste declines.

8. That, although the aggregate loss by fire constitutes a national problem, all fires are local in origin and are, therefore, locally preventable and controllable.

9. That property owners generally have not been sufficiently influenced by their own interests or the welfare of the country at large to use effective means to correct fire-waste conditions.



Annual per capita fire loss in Canada and other countries

10. That existing legislation respecting the prevention of fire is inadequate and lacking in uniformity.

11. That such legislation is almost entirely confined to cities and more important towns, and that the dangers and hazards of fire in small communities and rural districts are without regulation or control, despite the occurrence of a large proportion of the fire waste in rural districts.

12. That the only possible solution of the national fire-waste problem lies in the adoption of compulsory

measures which, by reducing to a minimum the fire hazards in all communities and properties, will prevent the occurrences of fires.

13. That, owing to the failure of local authorities to deal adequately with the situation, the Provincial governments should undertake the removal of a burden imposed upon the whole people and should safeguard the lives and property which, in the final analysis, constitute the true wealth of the country.

Standardize Engineering Practice

The Canadian Engineering Standards Committee, which has just been formed, is undertaking work which should prove of paramount importance to this country. The great object is to standardize engineering practice, and in this connection it may be pointed out that the application of these standards to our industry will determine to a certain extent the part Canada will play in the future as an exporter of manufactured goods. We are all looking forward to our country holding a portion of the now abnormal foreign trade, and to do this we must follow the example of others in the matter of standardization.

This practice is also of the utmost economic value. The primary object of the committee is to secure interchangeability of parts to cheapen manufacturing by the elimination of the waste entailed in producing multiplicity of designs for one and the same purpose, to effect improvements in workmanship and design, and by concentration rather than by diffusion of effort to expedite delivery and reduce manufacturing charges and storage.

The appointment of the Committee has been made at the request of the Institution of Civil Engineers of Great Britain, which fathered the movement for the establishment of the British Standards Committee.

This committee, (which works in conjunction with the Board of Trade), from which the Canadian committee has been patterned, is representative of the whole engineering industry of Great Britain and is competent to examine all proposals for improvements, to assimilate the best out of them all, and as a result, to recommend standards based on a sure and strong foundation, upon which new developments can be built. The good results obtained by the British Committee, as showing the enormous value of standardization to production, suggested the formation of similar committees in the British Dominions, leading to the general standardization of engineering practice in the Empire.

There is a further field, however, and a wider aim and object, for the British Committees are preparing to co-operate with the Engineering Standards Committee of the United States, just established under the approval of the great engineering organizations of that country. Because of the wide difference in some of the methods in engineering practice between Great Britain and the United States the work of the Canadian Committee will have an important bearing in harmonizing these differences

The following are the members of the committee, representing the Federal Government, Canadian Manufacturers' Association, Canadian Mining Institute, Institution of Civil Engineers of Great Britain, Advisory Council for Scientific and Industrial Research, and Engineering Institute of Canada.

Federal Government: Lieut.-Col. W. P. Anderson, C.M.G., M.E.I.C., chief engineer Department of Marine; Dr. E. Deville, surveyor-general, representing the Department of the Interior; Dr. A. B. Macallum, F. R. S., chairman of the Advisory Council for Scientific and Industrial Research; Lt.-Col. C. N. Monsarrat, M.E.I.C., consulting engineer, Department of Railways and Canals; Captain R. J. Durley, M.B.C., M.E.I.C., representing the Imperial Ministry of Munitions; Major W. J. Keightley, chief inspector of military stores, representing the Department of Militia; Mr. E. O. Way, chief inspector weights and measures, representing the Department of Inland Revenue; Mr. K. M. Cameron, M.E.I.C., supervising engineer, Department of PublicWorks, Ottawa, representing the Department of Public Works.

The Canadian Manufacturers' Association: Mr. William Inglis, John Inglis Coy., Ltd., Toronto; Mr. P. L. Miller, general manager, Canadian Vickers, Ltd., Montreal.

Advisory Council for Scientific and Industrial Research: Mr. Robert Hobson, president Steel Co. of Canada, Hamilton; Prof. J. C. McLennan, F.R.S., University of Toronto; Mr. R. A. Ross, M.E.I.C., City commissioner of Montreal and consulting electrical engineer; Dr. R. F. Ruttan, McGill University; Mr. Arthur Surveyer, M.E.I.C., consulting engineer, Montreal.

Institute of Civil Engineers of Great Britain: Sir John Kennedy, Hon. M. E. I. C.; Mr. W. F. Tye, M. E. I. C., consulting engineer, Montreal; Mr. H. H. Vaughan, president Engineering Institute of Canada, general manager Dominion Bridge Co., Ltd., Montreal, and Dr. John B. Porter, M.E.I.C., professor of mining engineering, McGill University.

Engineering Institute of Canada: Mr. G. H. Duggan, M.E.I.C., managing director, Dominion Bridge Co. Ltd., Montreal, and Dr. L. A. Herdt, M.E.I.C., professor electrical engineering, McGill University.

Canadian Mining Institute: Dr. Alfred Stansfield, professor Metallurgy, McGill University, and Mr. F. H. Crockard, Nova Scotia Steel and Coal Company.

At the organization meeting, Sir John Kennedy, to whom the formation of this committee was suggested by the late Sir John Wolfe Barry, was appointed chairman, and Mr. H. H. Vaughan and Captain R. J. Durley, vice-chairmen, Dr. J. B. Porter was elected hon. secretary-treaseurer, and Mr. Fraser S. Keith secretary. The headquarters of the organization are at the Engineering Institute of Canada building, Montreal.

At the request of the British committee, sub-committees on screw thread and aeroplane parts were created under the chairmanship of Mr. H. H. Vaughan and Captain Durley respectively. It is intended that other sub-committees shall be appointed as required.

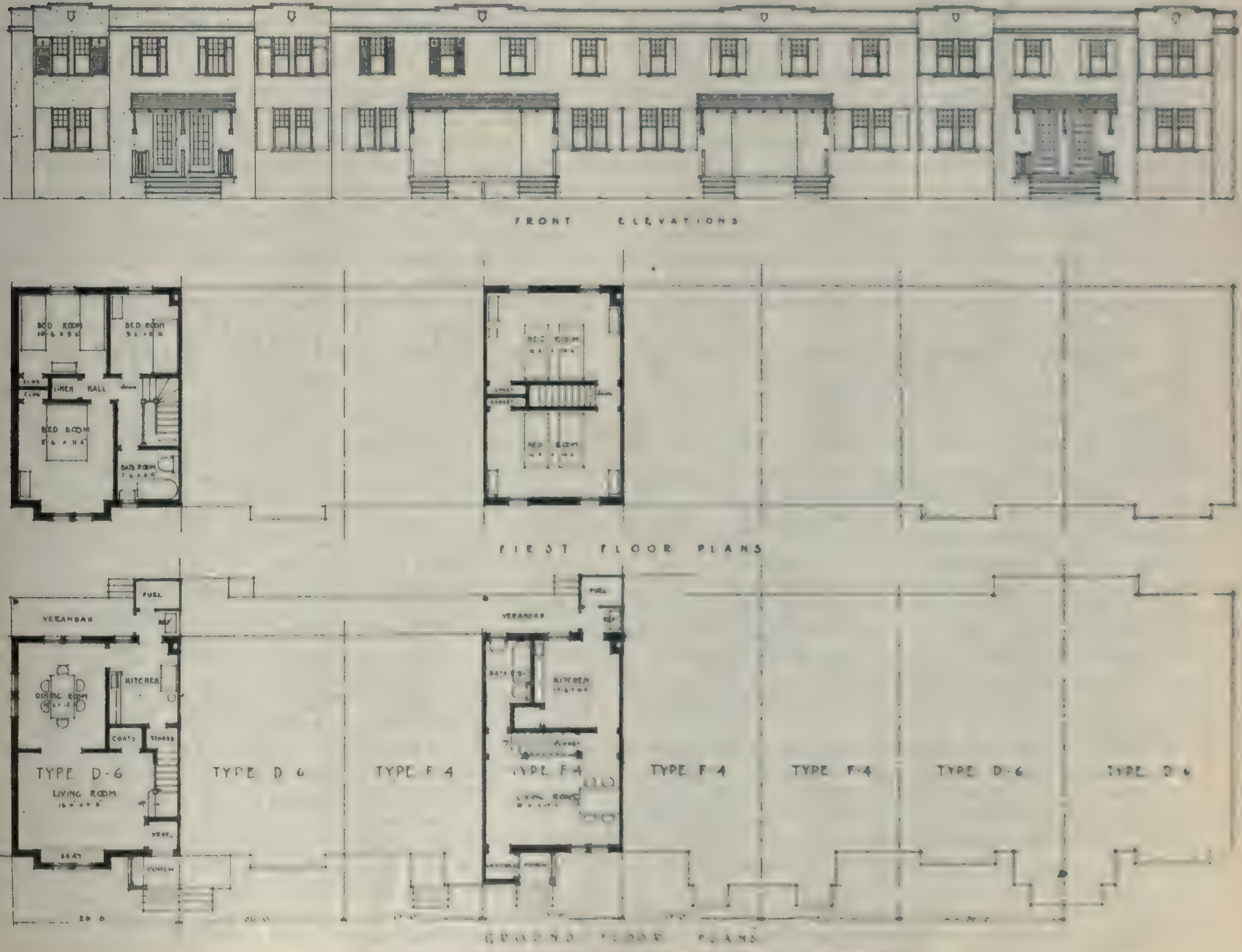
With a view to securing economical and efficient work the Administrative Commissioners of Montreal have appointed Mr. Charles Garrett and Mr. A. E. Doucet, civil engineer, Quebec, to advise on contracting and engineering work. The appointments are temporary. Mr. Garrett will report on the contracting work, and Mr. Doucet will be consulted on engineering. The former has been engaged on railway work in West Africa, and has also carried out railway construction contracts in Ontario, Nova Scotia, and Quebec. He was formerly connected with the Sudbury Dynamite Works and the Hamilton Powder Co. Mr. Doucet, who is a member of the Engineering Institute of Canada, was at one time district engineer for the Transcontinental Railway and chief engineer of the Lake St. John Railway.

Industrial Housing Scheme Under Way

As indicated in a previous article, industrial companies are paying more attention to the housing accommodation of their workmen. Experience has shown that the provision of good houses is an important factor in retaining skilled help, and that men with families are not inclined to remove to other localities when they have comfortable and convenient homes. This is especially so where opportunities are afforded for the men to become owners of the houses. From the companies' standpoint, the advantage of a continuance of reliable help is manifest..

The pulp and paper companies in the province of Quebec have done, and are doing, a great amount of work in the direction of supplying good houses for their employees. One of these, The Donnacona Paper Company, Ltd., of Donnacona, P.Q., is now erecting several types of cottages, from plans by Mr. J. Cecil McDougall, A.R.I.B.A., architect, Montreal. The houses, which are intended as a renting proposition, are built in terraces of eight houses, consisting of four six-room cottages and four four-room cottages, with a central heating plant located in the basement of one of the houses. Each room is equipped with a radiator of the usual type, the heat being controlled at the will of the tenant. The heating is under the charge of the company, its cost being included in the rent. The chief advantages are more efficient and economical heating, and the saving in capital cost by the substitution of a large heating apparatus for eight small furnaces.

The six-room cottages measure 20 x 26 ft., and the four-room cottages 17 x 26 ft., in addition to which there are gardens in the front and rear of each house. Each cottage consists of two stories. The foundations are of concrete; the exteriors of stucco; and the interiors of plaster. The floors are of hardwood. The roof is flat, of tar and gravel, with central draining. The cottages are planned so as to give the maximum of convenience, and both types have some features in common. Thus each has porches and vestibules, and long verandahs in the rear. In the six-room cottages, the vestibule opens into the living room, which is 11.6 x 15.6 ft., and has a bay window with a window seat over the radiator. The dining room adjoins, and has



Layout of homes of industrial workers in employ of Donnacona Paper & Pulp Company.

direct communication with the kitchen, which is provided with built-in dressers and a store room; convenient to the kitchen and at the rear are refrigerator space, and fuel shed. The upper storey consists of three bedrooms, (two double and one single), bath-room, linen cupboard, and closets off each bedroom. The largest bedroom is 13 x 11.6 ft. The bathroom contains a closet, bath and basin.

The four-room type has a vestibule leading into a living-dining room, 16.6 by 10.6 ft., and has direct connection with the kitchen, 10.6 x 10.6 ft.; off this are the refrigerator and coal accommodation and also the verandah. The bath room is on the ground floor. Two bed-rooms are placed on the upper floor, each having closets. Each bed-room measures 16.6 x 10.6 ft. and is provided with two windows.

Causes of Failure in Bituminous Macadam Pavements

THE popularity of the macadam pavement when improved by the addition of bitumen, using either the mixing or penetration method of construction is well recognized. While it was found that a macadam road bore up well under horse-drawn vehicles the advent of motor traffic caused serious damage to the road surface and consequently the plain macadam road would no longer meet the demands made upon it. Although the bituminous macadam pavement renders good service under motor traffic, too much importance cannot be placed on the necessity of observing certain requirements in both the materials and methods of construction if failures are to be avoided. Referring to the cause of certain failures in bituminous macadam pavements, the following article from "Good Roads," by H. Walter Leavitt, assistant professor of civil engineering, University of Maine, sets forth some of the main reasons why bituminous macadam pavements do not, sometimes, stand up well under traffic:

The subject of failure can best be classed under two heads, as follows:

1. Failures due to the condition of the materials.
2. Failures due to the methods of construction.

Under the first class may be included the unjustifiable combinations of the bitumens, unsuitable materials; overheating of the same; and, in the case of tars, improper dehydration or removal of water content. An example of unjustifiable combinations would be that of coating a perfectly good asphaltic base with a soft oil top; likewise using too large a percentage of asphalt in a tar mixture, thus producing a cheesy appearing product. Sufficient knowledge to warrant the mixture of the different classes of bituminous materials is at present not obtainable. Many have been the times that there has been used for a binder an unsuitable material—a material adapted neither to climatic conditions nor to conditions of traffic. Another defect in the bitumen is due to its being overheated. This injurious result may be caused by so little a thing as letting a steam roller stand too long over one spot of the pavement. The heat from the firebox is sufficient to produce brittleness in the surface beneath and so ruin all of the essential characteristics of the binding medium.

In England the so-called pitch-grouted macadam has been known to fail because of containing water, because of being badly tempered, because of being mixed with dirty sand or sand at the wrong temperature. This type of surface is equally susceptible to dampness; e.g., if the roadbed is wet, or if the rain has caused the macadam to be splashed with mud, or even such a trifling affair as a leaky injector or a badly packed pump gland in the roller, may cause a weak spot in the finished surface to develop even several months after the work has been completed.

The asphalt macadam pavement of England, according to Cecil Nathan, works thus:

"In the penetration method the hot asphaltic cement immediately as it is poured on the cold stones, becomes chilled and fails to penetrate as it is intended to do, with the result that instead of the voids being entirely filled with the asphalt cement, it merely runs down through the voids in small strings, which are not of the slightest use for holding the stone in place below that at the very top. Hence attrition takes place below the top surface and the roadway is liable to quickly disintegrate under fast and heavy moving traffic."

Defective Materials.

Failures may as appropriately be attributed to the kind and condition of the aggregate as the bitumen used. The selection of the stone is important. The use of soft stone, especially in the districts where local stone is used, is a very common cause of failure. Soft stone when placed in the pavement and rolled may be treated with bitumen and all cracks or fractures which may have been made by the initial rolling may be covered, but the rolling of the pavement, both after the first application of the bituminous material and in the final compacting of the same, will again fracture more or less of the stone aggregate. These fractures occurring as they do after the application of the bituminous material, will weaken the pavement and the stone will immediately start to break down under continued rubbing of one piece against the other. This in itself produces dust and allows moisture to penetrate into the pavement, again causing further destruction of the binding powers of the bitumen. In addition, the soft stone is readily worn away by passing vehicles and serves to shorten the life of the pavement.

Stone crushed in quarries where there is an abundance of stripping or where there is a stratum of soft stone, or stone hauled upon the highway and allowed to stand for several days subject to clouds of dust from passing vehicles, becomes coated with a thin film of dust particles. Stone of this character, when placed in the road and subjected to the application of bituinous material cannot be properly bonded, in such as the bitumen, when covering each stone, is unable to directly bond itself to the stone proper, because the dust layer covering, the stone will act as a barrier and, while the bituminous material will or may hold the stone in place in the pavement, there will not be the proper bonding of one particle of stone with another. Stone with a very smooth non-porous surface will prove a failure on account of the inability of the binding medium to adhere thereto. Wet or even slightly damp stones result likewise in the bituminous material obtaining no adhesion. It is well also to avoid those classes of stone which do not crush in a cubical or near-cubical shape. Flat particles of aggregate will give unsatisfactory results. Stones that break or crush in splinters will not take the compression and will not interlock themselves one with the other in the manner most desired in accomplishing first-class results.

In selecting a rock type for use as aggregate in bituminous macadam construction the engineer must bear in mind the function of the material in the pavement. In a bituminous road the individual particles making up the structure are bound together with the bitumen, and, therefore, it is not necessary that the rock possess any cementing properties. It must, however, bear the weight and withstand the abrasive action of traffic. The rock that will fulfill these requirements must be tough and also give a good abrasion test. It is not necessary that the specimen have a low absorptive power, since the bituminous material will tend to fill the small openings in the rock particles.

Defective Construction.

The second general class of failures of bituminous macadam pavements, namely those due to methods of construction, may be traced to the following causes:

1.—Insufficient rolling, either of the foundation or of the final surface, or both.

2.—Uneven distribution of the bituminous material. This has been somewhat eliminated by the use of power distributors.

3.—Employing the wrong sizes of stone. Modern practice is to use larger stones in the wearing course.

4.—Formation of fine surface cracks caused by the rocking movement of the individual stones under the action of traffic and finally resulting in a raveled or disintegrated roadway.

5.—Segregation of sizes of stone, preventing uniform penetration. This condition produces "lean" or weak places in some cases, and "fat" or rich spots in others. One is as bad as the other.

6.—Constructing when stones are wet or damp. Many is the surface that has gone to pieces because the bitumen was applied as soon after a storm or shower as the surface looked dry in the bright sunlight, but was in fact dried out only on the top.

7.—Either an insufficient or an excessive amount of bituminous material.

8.—Lack of sufficient covering of stone chips or materials of a similar character. This condition produces a sticky or a mushy surface.

Conclusions.

Any of the above failures, either of materials or of construction may be the result of:

1. Faulty plans or specifications.
2. Incompetent contractors or inspectors.

It has been stated that probably the most noticeable cause of failure of high class pavements is that incompetent contractors, having absolutely no experience in bituminous pavement construction, bid on highway work and look to the engineering department as a school of instruction for their special guidance. With incompetent contractors may be classed inadequate equipment and inexperienced labor for both the skilled and the unskilled parts of the work. Incompetent inspectors will always be on hand until the various highway departments realize that competency has to be paid for as well as high class and dependable materials.

This, then, in general, is an outline of the most common failures to be encountered in bituminous macadam pavements. As we often profit most by our mistakes and never become truly great without some errors encountered, it is hoped that this brief article will bring very close to the minds of highway engineers the follies of past years, the shortcomings of both native and foreign road builders, and in so doing help in many ways the building of future highways and the placing of the bituminous macadam pavement on a higher plane of efficiency—a well deserved position.

Value of the Plane Table in Surveying

ALTHOUGH the value of the plane table as a surveying instrument has long been recognized among engineers generally, it is surprising how seldom this method is employed in actual practice. The reason is probably due to some extent to the tendency among engineers to adhere to transit work as being the method universally employed, and the unwillingness on the part of the engineer to depart from a method in which he has attained a high degree of proficiency in speed and accuracy at the expense of long and varied experience.

Again it may be due to certain features of the plane table itself which make it objectionable as a part of the surveyor's equipment. It has been criticized as being a somewhat clumsy instrument, and one which is not sufficiently rigid to withstand severe usage, as well as a method in which the accuracy of the work performed is open for debate.

The practical difficulties attending the use of a drafting board in the field, in a climate where the weather is very changeable should not, and no doubt have not, been overlooked in considering the merits of the plane table, but whereas it is quite probable that the plane table could be more widely used with good results, the nature of the country and work in hand largely determine whether this method could be used with advantage or not.

Where the country is heavily timbered and very rough, the transit takes precedence over the plane table, but for work in open country, especially on large drainage projects, there is little doubt that the use of the plane table greatly reduces the ultimate cost of the work as well as increases the speed and requires less men in the field organization.

Another point in favor of the plane table is the ease of operation and the facility with which a man without training may learn to operate it, a point which is of great importance in every survey party, and will probably be more so after the war when the supply of technical men, judging from present indications, will be inadequate to fulfill the coming demands.

In the plane table method the drafting work is done on the ground and is therefore likely to be more accurate than if it were done a month or so after in the office.

Then again the mechanical construction of the plane table is of the simplest nature; there are no horizontal plates to become distorted, and when equipped with a good telescope the range of sight is ample.

The great disadvantage of transit methods for filling in topographical details seems to be due to the prevailing practice of requiring the transit man to have too many duties to perform in order to keep down expenses in the party. When the survey is over, the transitman turns his field books over to the draftsman; then he goes out on another job, leaving the draftsman to join up the contours from the notes available, and he, not being on the ground, has no check whatever on the reliability of the finished plan.

Many surveyors and engineers overcome this probable field for inaccuracy by requiring the transitman to plot his own notes as soon as the survey is completed. While this is no doubt a better course to pursue, the transitman will often have to "stretch his memory" and inaccuracies are bound to creep in.

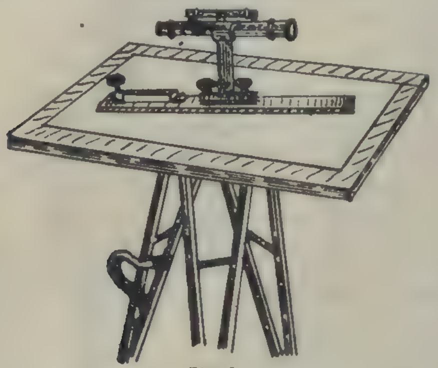


Fig. 1.

It therefore seems probable that the popularity of the plane table for certain classes of work is bound to increase where it is desirable to eliminate as far as possible the office work connected with every engineering survey.

Having dealt with some of the advantages of the plane table, it would probably be opportune to give a description of the instrument, together with its method of operation.

Description and Method of Using the Plane Table.

The plane table has been described as a graphical surveying instrument, easily manipulated, and by which points in the field may be located directly by drawing lines on paper which intersect at the actual angle between the points on the ground.

While the simplest form of plane table is not equipped with a telescope but has a sighting arrangement similar to that of the ordinary surveyor's compass, the better type is equipped, as shown in Fig. 1, with a telescope on the alidade, which greatly increases the range of sight as well as the accuracy of the work. The method of using the instrument is as follows: A point is chosen on the ground from which a clear view can be obtained of points whose relative position it is desired to obtain. Call this Sta. 1, Fig. 2, and let a, b, c, d, e, be the points to be located. Carefully set up the instrument at Sta. 1 and, after levelling the board, direct the telescope of the alidade to the point a, then with the alidade in this position, draw a line from the Sta 1, as plotted on the board. This line will be parallel to the line of sight taken on the point a. Next direct the telescope to the point b and to each of the points c, d, e, in succession, drawing a line from the sta. 1 in each case as above mentioned, using the straight edge attached to the alidade base as a guide. Next set up a picket at station 2, where it is intended to make the next set up, return to the instrument at sta. 1 and sight on the picket at sta. 2, drawing a line on the paper as before. Measure the distance from sta. 1 to sta. 2 either by stadia or direct chaining, and plot this distance from sta. 1, using a scale of, say, 400 ft. to the inch or whatever scale it is intended to use on the finished plan. Remove the plane table from sta. 1, being careful to set a picket here, then set up at sta. 2 at the previously measured distance from sta. 1, and set the direction of the board by means of the alidade, so that the line 2—1 on the board cuts the picket left at sta. 1. Direct the telscope as before to each of the points a, b, c, d, drawing lines from the sta. 2 for each position of the alidade. The intersections of these lines with those drawn when the table was at sta. 1 give the true positions of the points a, b, c. d, e, corresponding to the scale adopted in the base line 1—2, and these points of intersection, as shown by dot and dash lines, Fig. 2, when joined give a figure a′, b′, c′, d′, e′, on the paper similar in every detail except size to the actual figure on the ground formed by the joining up of the points to be located, as shown by a, b, c, d, e.

Where an extent of land is to be surveyed by the plane table method, longitudinal strips of about a mile in width are taken, and for open country work, as a means of filling in topographical features after a triangulation survey has been made of the district, the plane table method is very useful, and has been used extensively for this purpose. Large surveys were made in India with the plane table as the climate in that country was well adapted for its use. Scaling distances between the rectangular coordinates plotted on the map is a good check for accuracy. For example, coordinates plotted 5 inches apart on a scale of 600 ft. to the inch would give 3,000 ft. on each axis. If the tested distance is found to be 2,995 ft. there is an error of paper shrinkage of 5 ft. in 3,000 ft. and the corresponding correction can be applied to plotting of instrument readings. Since most distances for lengths of courses for table stations are more nearly in the neighborhood of 400 or 500 ft; this correction may be neglected.

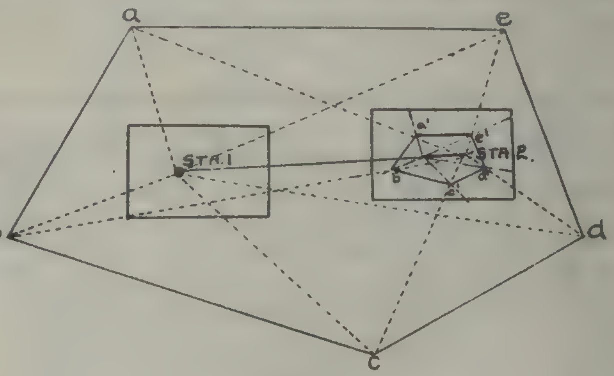


Fig. 2.

The organization required for plane table work is an instrument man and two rodmen, no recorder of notes being necessary. Side-shots may be taken to the nearest tenth and can be made mentally with the H. I. always in sight.

The plane table is not mathematically an exact instrument as far as the readings are taken when the alidade in many instances is not precisely centered over the plotted station occupied, but there is probably little doubt that the ground as shown on the finished plan, prepared by the plane table method more nearly represents the real relative elevations of the ground than the plan made in the office by the transitman from notes which have to be filled in from memory in many instances.

Proportioning the Materials of Mortars and Concretes by Surface Areas of Aggregates

IT has long been recognized by investigators of mortars and of concrete that the methods of proportioning in common use are "illogical and unscientific," and in consequence new methods have been proposed from time to time. However, none of these have been generally accepted. The volume method and the void method, neither of which take into account the granulometric condition of the aggregates, have been in general use for a century or more, and no doubt can be entertained as to the need of more scientific methods of proportioning. In a paper, "Proportioning the Materials of Mortars and Concretes by Surface Areas of Aggregates," read at the recent joint meeting of the American Society for Testing Materials and The American Concrete Institute by Capt. Llewellyn N. Edwards, U. S. Engineers Reserve Corps, a new method radically different from any previously proposed, is brought to the attention of the engineering profession. This paper contains forty-nine pages, in which Capt. Edwards describes the methods used and the results obtained in the development of information relating to the surface areas of sand and stone aggregates; the methods and materials used, the results obtained and the phenomena observed in a series of experimental tests undertaken to develop the practical application and efficacy of this method. The paper gives ample evidence of the labor and painstaking care spent in the work described.

Although Capt. Edwards' paper contains much valuable information relating to the composition of mortars and concretes, our space permits only an abstract of its most prominent features, viz.:

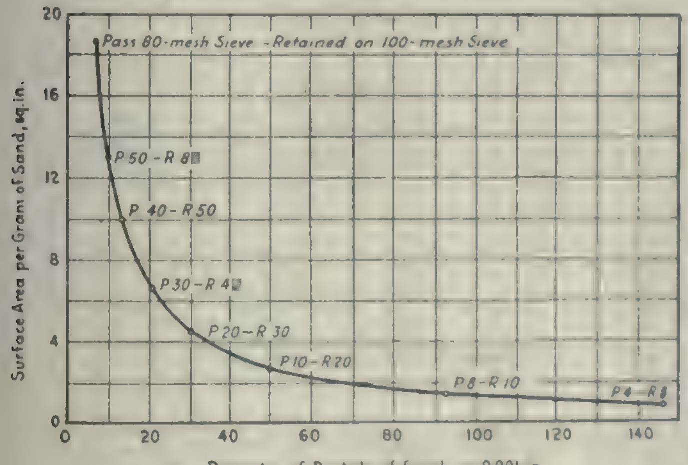


Fig. 1—Surface Area of Sand Aggregate

"1. The strength of mortar is primarily dependent upon the character of the bond existing between the individual particles of the sand aggregate. Upon the total surface area of these particles depends the quantity of cementing material. Furthermore,

"2. The amount of water required to produce a "normal," uniform consistency of mortar is a function of the cement and of the surface area of the particles of the sand aggregate to be wetted.

"The shapes of particles of sand and of stone aggregates are infinite in number and for this reason no accurate determination of their surface areas is possible. However, it is reasonable to assume that these areas can be closely approximated. Doubtless these approximate areas do not vary greatly from the true areas in the finer particles of sands, since these particles, when examined under the microscope, appear more nearly spherical than do the larger particles of sands and of gravels.

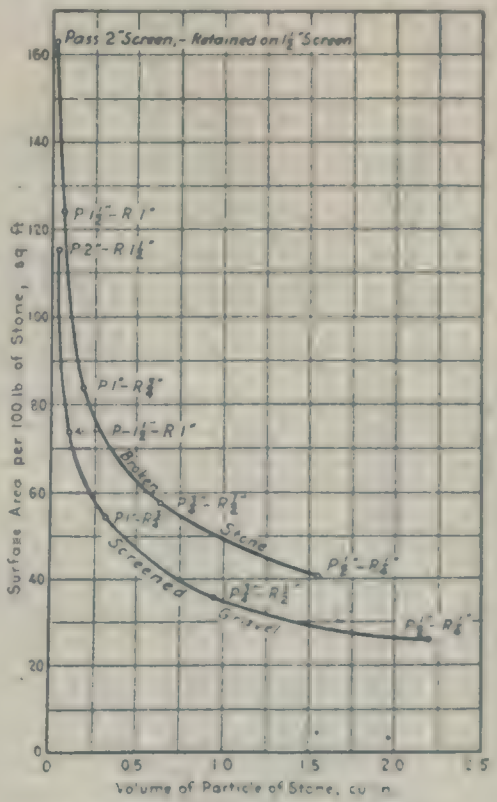


Fig. 2—Surface Area of Stone Aggregate

In this determination of "the approximate average surface areas of sand particles of varying sizes (the exact areas cannot be determined), samples of natural sands were secured from different localities. Each sand was thoroughly dried and divided by sieving into its component sizes."

"For each sand the average number of particles per gram was determined, for every size of each sand, by an actual count. For the larger sizes 8 to 10 g. or more, and for the medium sizes 3 to 5 g., were counted; while for the smaller sizes 0.25 to 1 g. was counted.

"The number of particles per gram having been determined as above described, the specific gravity being 2.680 and the weight of water being assumed at 62.37 lb. per cu. ft.., the volume per particle was computed as follows.

Weight of sand material
=62.37 x 2.689=167.713 lb. per cu. ft.
=0.09706 lb. per cu. in.=43.0257 g. per cu. in.

Then,
43,0257 x number of particles per gram=number of particles having a total volume of 1 cu. in.

Whence,

$$\text{Average volume per particle} = \frac{1}{\text{Number of particles having volume of 1 cu. in.}}$$

Table I.—Grading of Sand Tests

Sieve Passed and Retained on.	Percentage Retained on Sieve.																
	Sand Letter.																
	A	B	C	D	E	F	G	H	I	J		L	M	N	O	P	Q
P 4 - R 8	15.0	25 0	5.0	25.0	0 0	10 0	30.0	0.0	0.0	8 0	10.0	15.0	8.0	14.0	11.0	11.0	9.5
P 8 - R 10	5.0	5 0	5 0	5 0	0.0	5 0	5 0	10 0	10 0	5.0	6.5	7.0	3.0	8 0	5.0	5.5	5.0
P 10 - R 20	25.0	23 0	15.0	15.0	0.0	18 0	30 0	25.0	25.0	22 0	16 0	22.0	11 5	21.0	16.0	18.0	19.0
P 20 - R 30	15.0	12 0	15 0	5 0	0 0	11 5	15.0	20 0	20.0	10 0	7.0	12.0	7.0	8 0	10.5	13.0	14.5
P 30 - R 40	15.0	15.0	15.0	5 0	0 0	18 0	10 0	15.0	15.0	14 0	16 5	14.0	10.5	12 5	15.5	16.0	20.5
P 40 - R 50	10 0	8.0	20 0	20 0	36 0	21 0	4.0	15.0	15 0	20 5	21 0	15 0	26.0	15.5	18 0	15.0	18.0
P 50 - R 80	10 0	8 0	20 0	20 0	52 0	15.0	4.0	10.0	10 0	20 0	21.5	13.0	32 0	19.0	20.0	15.5	12.0
P 80 - R 100	5.0	4.0	5.0	5.0	8 0	1.5	2.0	5 0	0 0	1 5	2.0	1.0	2.5	2.0	2.0	4.0	1.0
P 100	0.0	0 0	0 0	0 0	4.0	0 0	0.0	0 0	5.0	0 0	0.0	0.0	0.0	0 0	2.0	3 0	0 5
Total	100.0	100 0	100.0	100 0	100.0	100 0	100 0	100.0	100 0	101.0	100.5	99.0	100 5	100.0	100.0	101 0	100 0

"The average volume per particle being determined the shape of the particles was assumed as spherical and the surface area per particle and per gram of sand was determined accordingly."

The surface areas resulting from these computations are shown graphically in Fig. 1.

The methods above described for sand aggregates were followed in the counting of particles, computation of average volumes, etc., of stone aggregates. "In the determination of average surface areas the particles of broken stone were assumed to be made up of one-third cubical and two-thirds parallelepipedal shapes, the latter sub-divided to approximate more closely the areas of the elongated and slab-like shapes of particles. Gravel particles were assumed as spherical in shape."

The surface areas resulting from these computations are shown in Fig. 2. Table 1 gives the grading of the test sands used. These gradings were not predetermined, but instead "an effort was made not only to provide a range of gradings comparable with the usual gradings of natural sands, but also to include a few rather irregular or "freak" gradings."

Test Specimens and Testing.

"The test specimens made in connection with the various tests were as follows:

1. For the mortar consistency tests, standard briquettes only.

2. For the mortar strength tests, standard briquettes and cylinders 2 in. in diameter by 4 ft. long.

3. For the concrete tests, cylinders 6 in. in diameter by 12 in. long, and from the mortar content of the excess concrete cylinders 2 in. in diameter by 4 in. long."

In all mortar strength tests four 2-inch cylinders and four "standard" briquettes were tested at each age of 7, 30 and 60 days. In the concrete tests five specimens were tested at each age. For all tests the maximum load at ultimate failure was recorded.

"The marked influence of the consistency of the mix upon the ultimate strength of mortars renders it especially important that test mortars be made of uniform consistency. Tests were therefore made with the object of developing a means of securing uniformity of consistency in accord with the secondary or consistency theory of this method of proportioning, that is—'The amount of water required to produce a normal, uniform consistency of mortar is a function of the cement and of the surface area of the sand aggregate to be wetted.'"

As a result of many preliminary tests, to which only so-called "cut and fit" methods were found to be applicable, it was found that "normal," uniform con-

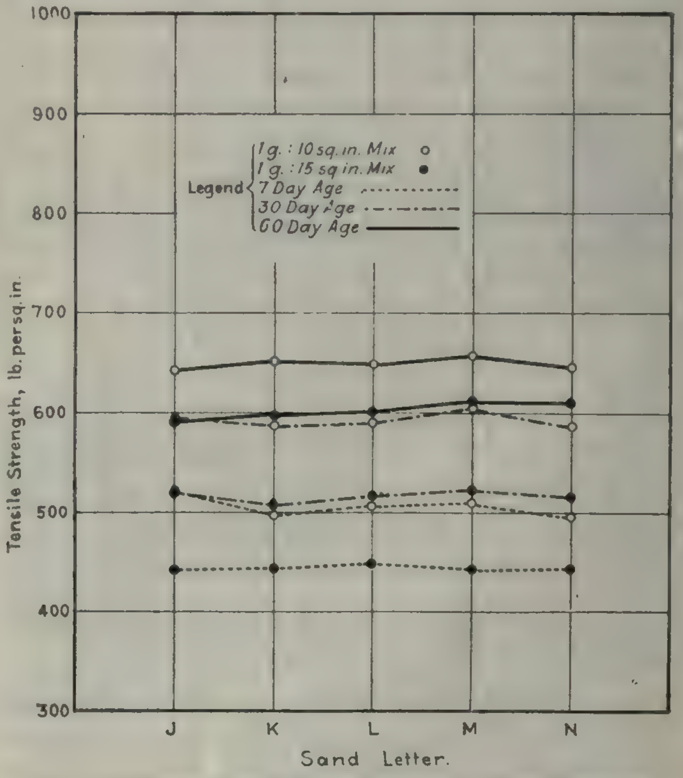


Fig. 3—Consistency Tests—Tensile Strengths of Mortar Briquettes

sistency mortars of varying cement content and of varying sand gradings were produced when the quantity of water used in the mix was made equal to (1) that required to reduce the cement to a normal consistency paste, plus (2) an amount equal to the surface area of the sand in square inches divided by 210, that is,

$$\text{Water (cc.)} = \text{(Weight of cement (g.) x percentage required to produce "normal" consistency paste.)} + \frac{\text{(Total surface area of sand (sq. in.).}}{210}$$

With a water content determined by the above quotation, each of the five test sands, J. K. L, M, and N, was used in the preparation of two test mortars having cement contents proportioned 1 g. cement: 10 sq. in. sand area and 1 g. cement: 15 sq. in sand area, respectively. The composition of these mortars is shown in Table II. Standard briquettes for tension tests were made from each mortar. The strengths of these briquettes are shown in Fig. 3.

Table II.—Consistency Tests: Composition of Mortars

Sand Letter	Surface area per 1000 g. sq. in.	Cement content 1 g.: 10 sq. in. Cement, g.	Water, cc.	Cement content 1 g.: 15 sq. in. Cement, g.	Water, cc.
J	7151	715.0	193.0	477.0	140.0
K	7301	730.0	197.5	487.0	143.5
L	5745	574.5	155.0	383.0	112.5
M	8811	881.0	238.0	587.5	172.5
N	6498	650.0	175.5	433.0	127.5

Mortar Strength Tests.

"The means of securing a "normal," uniform mix having been determined, little difficulty was encountered in the preparation of test mortars to establish the efficacy of the primary theory of this method, namely: 'The strength of mortar is primarily dependent upon the character of the bond existing between the individual particles of the sand aggregate. Upon the total surface area of these particles depends the quantity of cementing material.' "

Table III.—Strength Tests—Composition of Mortars

TEST SERIES No. 1
CEMENT CONTENT—1 G. : 13 SQ. IN.

Sand Letter.	Surface Area per 1000 g., sq. in.	Cement, g.	Water, cc.	Ratio of Cement to Aggregate by Weight.
A.	5 856.6	450 5	128.0	1 : 2 22
B.	5 106 1	392.0	111 5	1 : 2 55
C.	7 683.7	591.0	134 5	1 : 1 69
D.	6 758.4	520.0	148.0	1 : 1 92
E.	12 816 4	986.0	280 5	1 : 1 12
F.	6 769 1	521 0	148.0	1 : 1 92
G.	4 182.0	321 5	91 5	1 : 3 11
H.	6 564.6	505.0	143 5	1 . 1 98
I.	6 564 6	505.0	143 5	1 : 1 98

TEST SERIES No. 2
CEMENT CONTENT—1 G. : 10, 15, 20 AND 25 SQ. IN.

Sand Letter.	Surface Area per 1000 g., sq. in.	Cement, g.	Water, cc.	Ratio of Cement to Aggregate by Weight.
F.	6769	677.0	183.0	1 : 1 47
	6769	451.0	132 5	1 : 2 21
	[illegible]	[illegible]	105 5	1 : 2 95
	6769	270 5	92 5	1 . 3 61

TEST SERIES No. 3
CEMENT CONTENT—1 G. : 15 SQ. IN.

Sand Letter.	Surface Area per 1000 g., sq. in.	Cement, g.	Water, cc.	Ratio of Cement to Aggregate by Weight.
O.	7353 4	490.0	144 0	1 : 2 41
Q.	6391.0	426.0	126.0	1 : 2 35

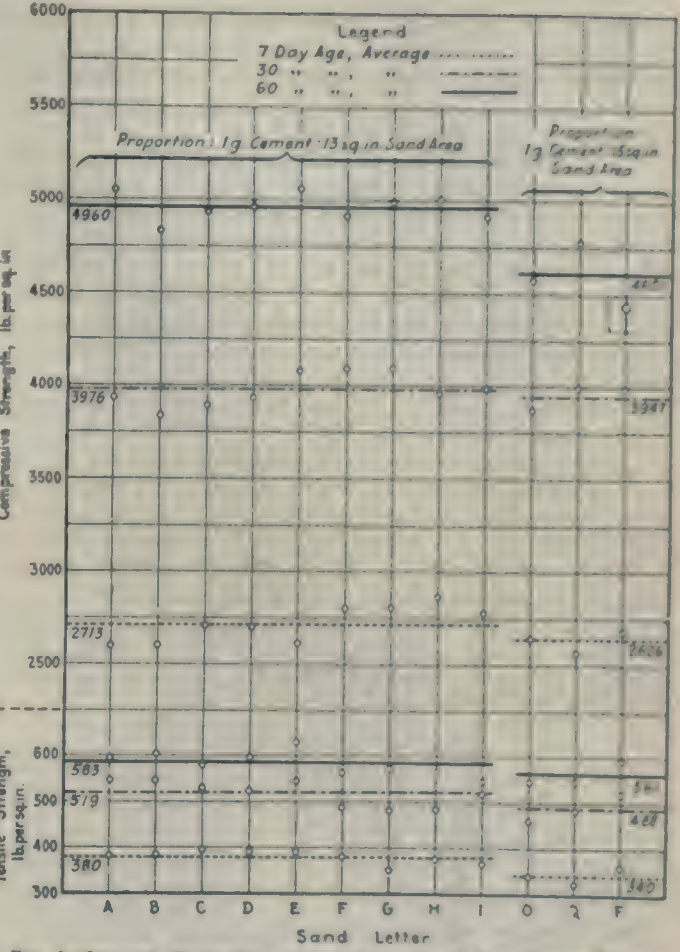


Fig. 4—Strength Tests—Compressive Strengths of 2-in Mortar Cylinders and Tensile Strengths of Mortar Briquettes

"Table III gives the composition of test mortars. It also shows for each mortar the ratio existing between the cement content and the sand aggregate, by weight.

"Fig. 4 shows the average ultimate compressive and tensile strengths obtained from test specimens of the first and third series, while Fig. 5 shows the results obtained from the specimens of the second series.

Concrete Strength Tests.

"Fig. 6 shows the average strengths obtained from the tests of concretes and from the tests of mortars

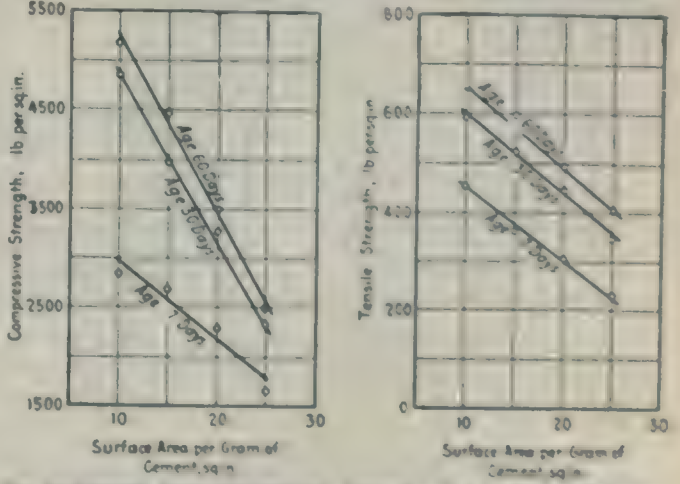


Fig. 5—Strength Tests—Compressive Strengths of 2-in Mortar Cylinders and Tensile Strengths of Mortar Briquettes, 1g cement: 10, 15, 20 and 25 sq in sand area

secured from the mortar portions of these concretes. For purposes of direct comparison, the average of strengths obtained from normal consistency mortars, sands O and Q, are also shown. In this connection a comparison with Fig. 7 is of interest.

"The weaker strength of the concretes as compared with the mortars is doubtless due in part to the weakening effect of cleavage planes produced by the stone aggregate. A comparison of the strengths shown in Fig. 7 indicates a probability that by this method of proportioning, the relative values of sands used in concretes can be determined from a comparison of mortars, the cement content of which bears a common ratio to the areas of the sands compared and the water content of which is the same as that to be used in the proposed concrete."

A test was made with the object of securing information indicating the change of strength resulting from a variation of the water content of the mix from that required to produce a "normal" consistency mortar to that producing a "sloppy" mix, such as is frequently found in concretes of too wet consistency. Table IV. gives the composition of the mortars tested. Sand F was used in this test. Fig. 7 shows the average strength obtained from the test specimens of each consistency of mix.

Effect of Excess Water.

"The proper function of the water content of a mortar mix is to combine with the cement in producing the pasty matrix which, when set, binds the particles of the aggregate into a uniformly strong stone-like material. The addition of a comparatively small quantity of water in excess of that required for the fulfillment of its proper function produces a very marked effect upon the structure of the cement matrix.

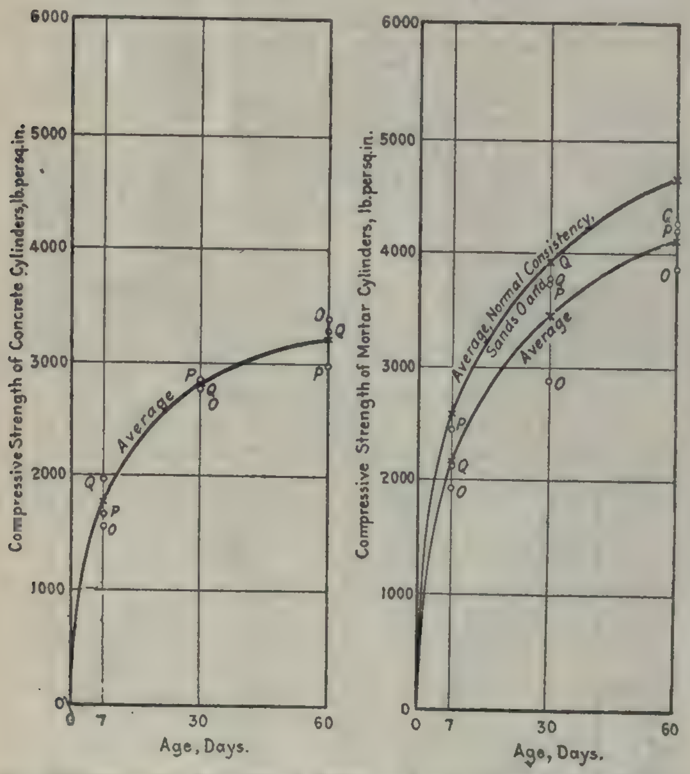


Fig. 6—Compressive Strengths of Mortar and of Concrete Test Cylinders

"This change in the structure of the cement matrix can be readily seen by the aid of a microscope; but like sunlight it is far easier seen than described. However, in the microscopic examination of the fractured surface of a "normal" consistency specimen, say, at 50 to 75 diameters magnification, the observer takes special note of three conditions of the matrix, namely:

1. It is grayish in color.
2. It adheres to the particles of aggregate in amorphous, pasty appearing masses.
3. It contains myriads of minute voids, permeating the entire formation.

"As compared with the above, the cement matrix of a "wet" consistency mortar specimen presents a radically changed appearance, that is:

1. Its color is changed from grayish to nearly a milky white.
2. It no longer adheres firmly to the surfaces of the

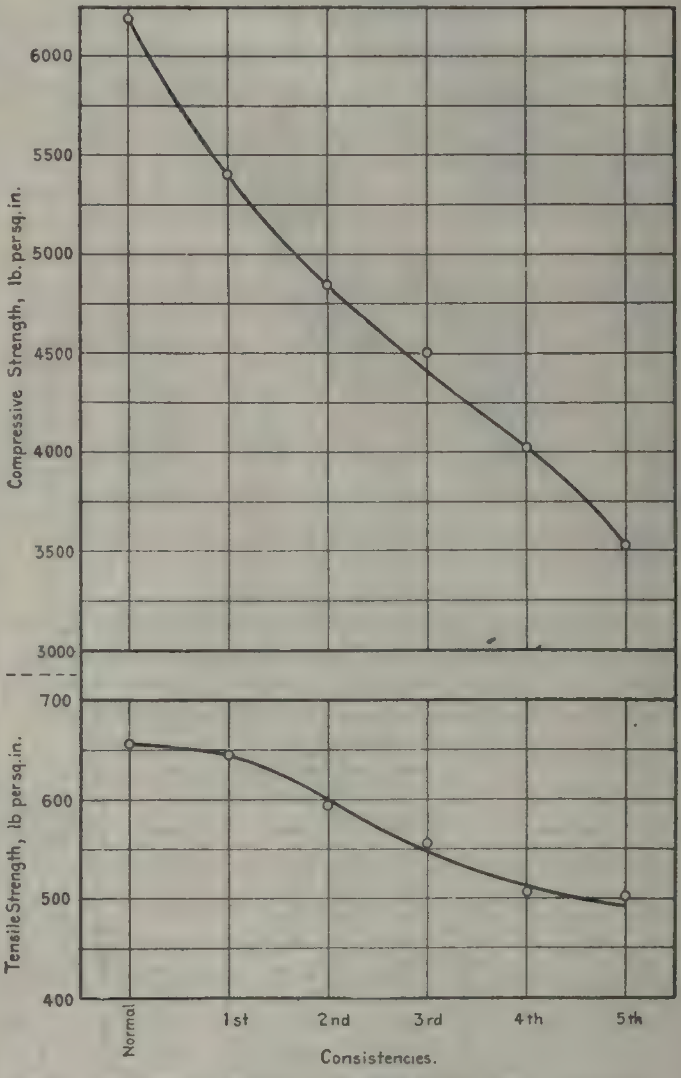


Fig. 7—Strengths of Mortars of Different Consistencies, Age 60 days; Sand F; 1g. cement; 10 sq. sand area.

Table IV.—Showing Tests: Composition of Mortars.
Test Series No. 2c.
Cement Content—1 g.; 10 sq.in.—Sand F.

Consistency	Surface Area per 1000 g., sq. in.	Cement, g.	Water, cc.	Percentage of water to Cemet and Sand
Normal . . .	6769	677	183	10.91
First	6769	677	217	12.94
Second . . .	6769	677	251	14.97
Third	6769	677	285	16.99
Fourth	6769	677	319	19.02
Fifth	6769	677	353	21.05

aggregate but instead appears as a comparatively loose, semicrystalline formation which, although containing few, if any, real crystal forms, may be compared to rather loosely massed snow crystals.

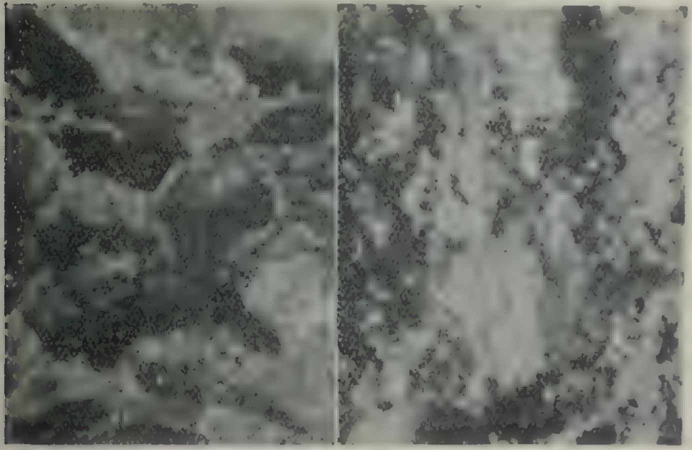


Fig. 8—Normal Consistency Wet Consistency

3. It contains, when closely examined, comparatively few of the well-defined globular-shaped voids observed in a "normal" specimen.

"When examined under a lower magnification, say 16 to 25 diameters, the matrix of wet-consistency mortar specimens presents a loose, "sugary" or granular appearance. Doubtless this change in the physical structure of the matrix from a comparatively dense, compact material to an attenuated, fluffed up, skeleton-like mass lacking cohesiveness and other attributes of strength discloses the deep underlying but nevertheless primary cause contributing to the low strength, friability, shortness and other undesirable properties found in wet consistency mortars and concretes."

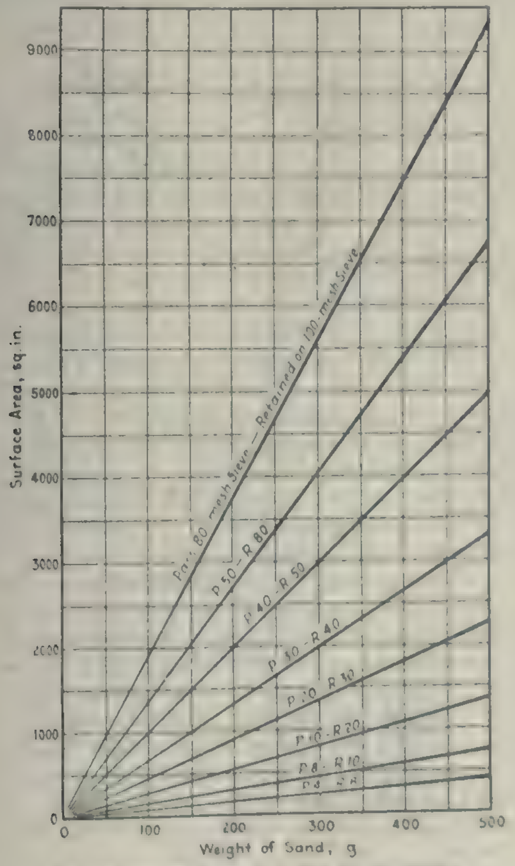


Fig. 9—Surface Areas (sq. in.) Corresponding to Various Weights of Sand Aggregates

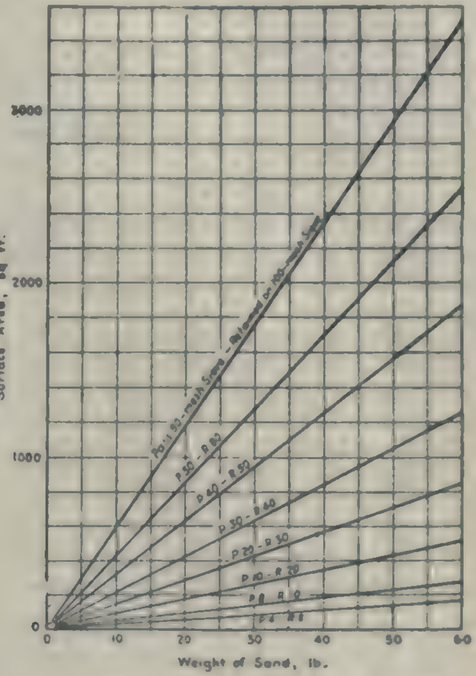


Fig. 10—Surface Area (sq. ft.) Corresponding to Various Weights of Sand Aggregate (lb.)

"Fig. 8 shows photomicrographs (x75) of "normal" and of "wet" consitsency mortar specimens. The latter specimen was produced from the mortar of the former by the addition of sufficient water to render it of a "mushy" rather than of a liquid consistency."

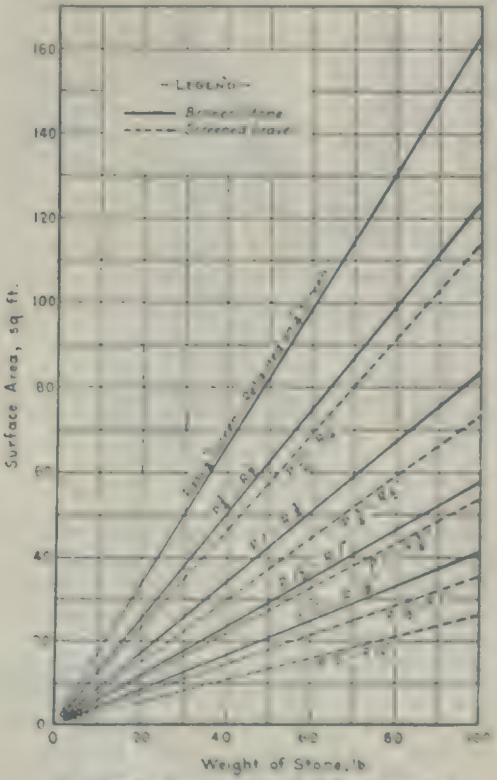


Fig. 11—Surface Area (sq. in.) Corresponding to Various Weights of Stone Aggregate (lb.)

Figs. 9 and 10 are designed for use in determining the surface areas of sand aggregate. The former is intended for laboratory use and the latter for both laboratory and field use.

Fig. 11 is designed for use in determining the surface area of stone aggregate and is intended for both field and laboratory use.

Fig. 12 shows a conversion diagram for determining the relative quantity of cement in pounds per 100 lbs. of sand from the corresponding relation of cement in grams to the surface area of 1000 g. of sand and vice versa.

Conclusions.

The following conclusions have been drawn by Capt. Edwards from a careful consideration of the results obtained and of the phenomena observed in his experimental tests:

1. The claim that the surface-area method of proportioning the cement content of the mortars and of concretes is essentially scientific and rational is proven by the uniformity of results obtained in comparative strength tests of mortars and concretes and by the phenomena observed in these tests.

2. With a given uniform proportion of cement in relation to the surface areas involved, this method provides a definite and practical means of comparing the relative strength-producing qualities of aggregates of varying physical, chemical and mechanical properties.

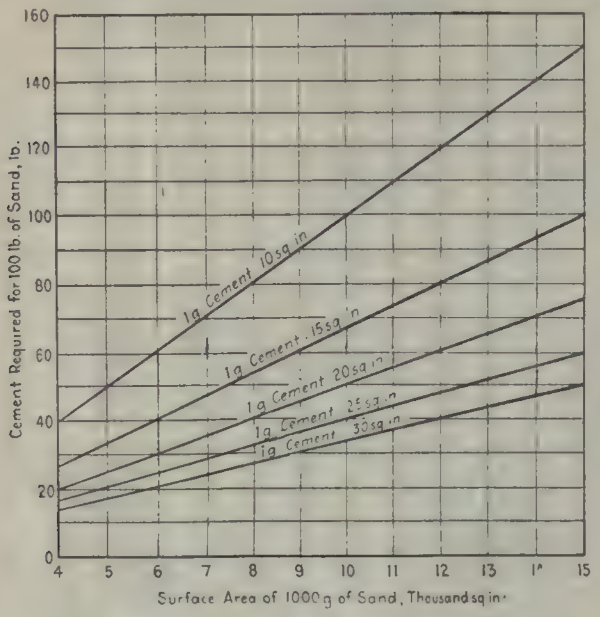


Fig. 12—Weights of Cement (lbs.) per 100 lb. of Sand Aggregates Corresponding to Various Surface Areas per 1000 g. of Sand Aggregate and Various Proportions of Cement to Surface Area

3. This method provides a means for a more thorough investigation of the functions of sand and stone aggregates and for a more complete development of the true values of all the component materials of mortars and concretes.

4. Excess water in an over-saturated mortar or concrete mix exerts a decidedly weakening effect upon the cement matrix by producing a change in the physical structure of the matrix which tends to destroy the cohesion existing between the particles of cement and the adhesion existing between the cement and the aggregate.

5. In a normal consistency mortar the relation of the area of the particles of the sand aggregate to the cement content of the mix determines the strength of the mortar, provided the strength of the sand material is greater than that of the cement matrix. A similar condition applies to concrete mixes not oversaturated.

Mortar.

6. The strengths of mortars containing a given cement and sand, but varying for the different mixes in the proportions of these ingredients, are directly proportional to the relation existing between the cement content and the surface area of the aggregate. It follows, therefore, that the strength of a mortar of given mix being known, the mix of a mortar having a desired strength can be pre-determined for the same materials.

7. The quantity of water required to produce "normal," uniform consistency mortars from a given cement combined in varying proportions with sands having the same origin, but varying in their granulometric composition, is a function of the water required to reduce the cement to a "normal" paste and the surface area of the sand particles to be wetted.

8. The increase of volume due to the mingling of varying quantities of cement particles with a uniform quantity of a given sand bears no apparent relation to and is evidently not dependent upon the void in the sand.

Concrete.

9. The tests indicate a probable definition relation between the ultimate compressive strength of the mortar content and the ultimate compressive strength of the concrete when the test specimens of the former are produced from mortar of the same mix and consistency as that used in the concrete."

Saves Money by Arc-Welding

A large manufacturer, working on munitions, has installed a Westinghouse arc-welding equipment for the sole purpose of making tools for turning shells. Ordinarily these tools are made from high speed steels and cost about $12.00 each. This manufacturer uses high-speed steel for the tip of the tool only, welding it to a shank or carbon or machine steel, and in this manner the tools are produced at a cost of $2.00 to $4.00. For several weeks this plant has been turning out 240 welded tools per day, the men working in shifts of four, which is the capacity of this outfit. The equipment consists of a 500-ampere arc-welding motor-generator with standard control panel, three outlet panels for metal-electrode welding, and one special outlet panel for the use of either metal or graphite electrodes. This special panel is intended to take care of special filling or cutting processes which may be necessary from time to time, but it is ordinarily used in the same manner as the other panels, for making tools. These four panels are distributed about the shops at the most advantageous points for doing the work, it not being necessary to have them near the motor-generator or main control panel. For toolmaking, which involves the hardest grades of steel, a pre-heating oven is used, not because it is necessary for making a perfect weld, but because otherwise the hard steel is likely to crack from unequal cooling, and also because pre-heating makes it easier to finish the tool after the welding process has been completed. For ordinary arc-welding operations the pre-heating oven is never used.

The Hunt Street Bridge, Hamilton, Ont., is out of commission pending the building of a new abutment and the laying of a new floor.

The city council of Belleville, Ont., in passing the estimates for the year fixed the tax rate at 35 1/10 mills, the highest rate in the city's history.

Temperature Tests on Concrete Columns

Much May Depend on the Particular Sample of Aggregate but, in the main, Limestone Mix Stands Up Better Than Gravel

There is no more useful line of experimentation being carried on to-day than that having reference to the action of concrete under fire conditions. Concrete and fireproof are two terms that have naturally become associated, and it is something of a surprise when a fire of the nature, for example, of that which occurred at the Quaker Oats plant at Peterboro, reminds us that temperature conditions may become such that even concrete will crumble and lose its normal properties.

On this account a resume of tests recently carried out by Mr. W. A. Hull, in the United States Bureau of Standards, and described before the recent convention of the American Concrete Institute, is of timely interest. The report deals largely with methods and is unduly long for a complete reproduction, but the conclusions covering tests on columns constructed with both gravel and stone aggrgates are given below. These show, in the main, that the limestone aggregate will withstand a high temperature much better than a gravel aggregate, though the tests also demonstrate that different samples of each give different results. The quantity and arrangement of the reinforcements also have an important influence.

Summary and Discussion of results with Gravel Concrete Columns.

It has been observed that in all gravel columns of this series, there has been a marked tendency for the outer concrete to break up early in the fire test, and for the resulting slabs and fragments to separate and fall off, exposing the load bearing portion of the column. The effect of this process, in the most extreme cases, is to strip the load bearing colum of its insulation, early in the fire test, with the result that comparatively high temperatures are reached in the steel and in the interior of the column. This spalling is most active in the columns having spiral reinforcement. Round columns with vertical reinforment, with ties every 12 in., suffered much less from spalling than those with spiral. Square columns, vertically reinforced, spalled and split badly. Round columns with no reinforcement showed an intermediate behavior between that of the round columns with spiral and those without. Strength tests made at the end of the 4-in. fire tests showed that gravel concrete columns with spiral reinforcement had retained from less than 15 to approximately 18 per cent of the strength of the duplicate column tested without exposure to heat. A round column with vertical rods and no hooping had retained approximately 30 per cent of its strength, square columns from 16 to 20 per cent and a plain column approximately 23 per cent.

These unfavorable results with gravel concrete are similar, in a general way, to those which have been observed, at various times, in laboratory heat tests and in fires in concrete buildings. Prof. Ira H. Woolson, in his final report to the American Society for Testing Materials, in 1907, on work done during 1905, 1906 and 1907, on the effects of heat on concrete, reported adversely on gravel concretes from the pure quartz gravel in extensive use in the vicinity of New York City. The following are extracts from this report:

"The writer is convinced that concrete made from this particular gravel is not reliable as a fire resisting material. Whether other grades of gravel would give equally unsatisfactory results is a matter for investigation.

"The cause for this failure of the quartz mixture is not easy to locate. The most plausible reason seems to be the relatively large coefficient of expansion of quartz. It is about twice that of fieldspar, which is one of the predominant minerals of trap rock. Clark's 'Constants of Nature', published by the Smithsonian Institute, gives the cubical coefficient of expansion for these minerals as follows: Quartz, .000036, Feldspar, .000017.

"According to the same authority, quartz has another peculiarity of expansion, namely, that the expansion in the direction of the major axis is only half that in the direction of the axis perpendicular to the major axis. This unequal expansion may further contribute to its tendency to disintegrate the conrete under action of heat."

Referring to this explanation, Professor Woolson says, in his report, published by the National Board of Fire Underwriters, on a fire in a reinforced-concrete warehouse at Far Rockaway, New York, Nov. 10, 1916:

"If this explanation is correct, as evidence thus far produced seems to sanction, all concrete specifications should contain a definite warning against the use of quartz gravel in concrete liable to be exposed to high heat. Where it is so used, Underwriters should take the fact into consideration in assuming the risk."

As already stated, concrete from the Pittsburgh gravel made an unfavorable showing in an investigation recently made by the Bureau of Standards with smaller specimens.

There is strong evidence that the peculiar behavior of the gravel concrete in our column tests is due to expansion; yet the Pittsburgh gravel is not made up of pure quartz pebbles. It contains a few quartz pebbles along with a much larger proportion of pebbles of sandstone and of other, harder rock, all appearing to be high in quartz. Inasmuch as most of our gravels have an exceedingly high quartz content, it would seem, from the information available at present, that any gravel aggregate should be investigated before being used, unprotected, in important work requiring fire resistive properties in the concrete.

The observations made in the course of these tests seem to indicate that a little anchorage or some light reinforcement, in the protective covering, might serve to hold the latter in place in hooped columns such as these, even though the covering were broken up by expansion. This is to be tried in later tests. It would seem, however, from a careful consideration of the action of these columns, in connection with the peculiar expansion behavior of quartz, that much depends on the suddenness of the heat treatment and that in fires in which the temperature rise is not particularly rapid, the tendency to expansion troubles would be much less than in fires producing heat with great rapidity. It should be taken into consideration that in these fire tests, the columns are not plastered and that the temperature rise is rapid, especially in the first half hour. It is conceivable, and even probable, that the protection of even a rather thin layer of some other material, such as plaster, over the concrete, would be sufficient to make the heating of the concrete enough more gradual to prevent the spalling. Some investigation of this phase of the problem is proposed as a part of the present series. It would appear that gravel concrete of a nature similar to that used in this investigation needs the protection of some other material, for while it is probably true that most fires in buildings do not have as sudden a temperature rise as that of these tests, yet is conceivable that with any one of a number of kinds of occupancy, an exceedingly rapid temperature rise can be produced, in a building, after the first few minutes requires for ignition to get well under way, over a large area.

Summary and Discussion of Results with Limestone Concrete Columns.

In the limestone concrete columns there was no spalling and very little cracking during fire test; this statement applies to square columns as well as to round columns with both types of reinforcement. Consequently, in all the tests of limestone concrete columns, the columns had the full benefit, during the entire fire test, of the insulation of that part of the concrete provided for fire protection and the temperatures shown, both in the steel and in the interior concrete, are correspondingly lower. It is seen, however, that in spite of this protection, temperatures were reached, in the steel and in the load bearing concrete, which would be expected, according to such knowledge as we have, to reduce the strength of both steel and concrete. In the spirally reinforced columns with this aggregate, it is not possible to give the ultimate strength of the columns at the end of the fire test, for obvious reasons, but it evidently was, in both columns, over 50 per cent as great as that of the duplicate column which was tested without fire exposure. These columns, after cooling, showed a strength approximating 70 per cent. and 77 per cent., respectively, of the maximum of the unfired column. Each of the vertically reinforced columns, both round and square, without spiral, tested while hot at the end of the fire test, showed a maximum strength approximating 50 per cent. of that of the unfired column of the same class.

It is obvious that the comparatively high strength of all the limestone concrete columns, at the end of the fire test, is consistent with the observation that there was no spalling and very little cracking during fire test; for not only did these columns have the full benefit of the heat insulation of the outer concrete, they must have been comparatively free from expansion stresses of various sorts which must have been important factors in the weakening of the gravel concrete columns. It should also be taken into consideration that there is some advantage thermally, in the decarbonation of the limestone next to the surface of the column. High calcium limestone decarbonates rapidly, under these conditions, at temperatures approximating 900° C. The reaction is endothermic, the decarbonation of a pound of limestone absorbing approximately the same amount of heat as the evaporation of three-quarters of a pound of water. Heat penetrates concrete with some difficulty and the absorption of heat in the course of its passage through an insulating material may become an important factor in retarding temperature progress in the protected member. This is pretty generally appreciated in connection with the thermal effect of the driving off of water, as in the dehydration of gypsum, but has not been so generally taken into consideration in connection with the driving off of carbon dioxide. Inasmuch as the quantity of limestone in the layer, of a thickness of ⅝ to ¾ in., which was decarbonated in these tests, was considerable, the thermal effect of the heat absorption should not be wholly disregarded. Furthermore, it is probable that because of its greater porosity, the decarbonated material would be a somewhat better heat insulator than the original limestone, so that, from the thermal standpoint at least, decarbonation of limestone may be considered as an advantage. As to compensating disadvantages of the decarbonation, this action is hardly to be charged with any weakening of the column, for any concrete which had attained a temperature of 900° C., could no longer be counted on for any considerable strength. As to salvage, the matter of repair, after a fire, the slaking off of the outer concrete to a depth of say ¾ in. might entail some expense in replacement, provided the concrete did not have to be replaced to a greater depth than this, irrespective of the calcination. But there may be some compensation for this in the fact that the depth to which the decarbonation of the limestone has propressed can serve, at least roughly, as an index to the severity of a fire and the probable condition of the inner concrete; this is at least a better index than judgment based on the depth to which the concrete appears to be dehydrated when attacked with a pocket knife.

Reinforcement.

It has been shown that gravel concrete columns with both vertical and spiral reinforcement gave particularly poor results, even poorer than those which had no hooping; the limestone concrete-hooped columns, on the other hand, made particularly good showings. It is obvious that the steel in the hooped gravel columns could not contribute much strength at the temperatures which it attained; it appears, however, that the hooping had something to do with the rapid breaking up and shedding off of the covering in these columns, so that the hooping may be regarded from these results, as increasing the hazard with gravel concrete. With the exception of this one type of column, it may be said that in all cases the reinforcement, although rather thinly covered at the best, gave a fairly good account of itself; it will be observed that in the gravel columns, both the plain ones and those vertically reinforced showed a maximum strength, after fire test, of approximately twice their working load, while both types of limestone columns showed strength approximating four times their working load; in the hooped limestone columns it was evidently somewhat higher than that.

General Conclusions.

It is obvious from the results of these tests that there is an important difference in aggregates in respect to the ability of concrete structural members containing them to withstand fire. From the showing made by these gravel concrete columns, together with the other evidence produced, there seems to be no way of avoiding the conclusion that unprotected concrete from some of our gravel aggregates, probably from many of them, is comparatively vulnerable to severe fires in which the initial temperature rise is rapid. This would probably not apply to gravels that were calcareous rather than siliceous in their nature, but would apply to aggregates of crushed stone from siliceous rocks such as sandstones.

The evidence in regard to limestones is less sweeping in its application than that in connection with the gravels because all the evidence presented has been gathered from tests of one kind of limestone. It is probable that some limestone might give better and others poorer results than those produced by this particular grade of stone.

The data so far obtained do not indicate that the proportional credits now being given for reinforcement of the types here represented would be appreciably affected by considering their performance in severe fire tests, provided the protective material remained intact.

It is evident that the insulation afforded by a thickness of 1½ in. of concrete is not sufficient to prevent loss of strength in columns, in a severe fire of long duration. On the other hand, all the limestone concrete columns tested in this investigation have shown an ultimate strength exceeding 3½ times the rated working load of the column. It appears from this that factors of safety employed in present engineering practice are sufficient to allow for the reduction in strength that may be expected in severe fires of four hours duration, assuming that the aggregate is not of a nature which tends to make the concrete liable to spalling. It would appears from these results that if more adequate insulation were provided, the factors of safety used in design could be reduced, so far as considerations of fire hazard are concerned, and that from the fire resistance standpoint, the use of insulating material, other than concrete, in the protection of columns, would be worthy of consideration.

The factors of safety used in engineering practice in the design of load bearing structural members are only such as are considered necessary to assure adequate strength, in these members, at ordinary temperatures. It may be stated, therefore, as a fundamental principle of fire protection, that load bearing structural members, of reinforced concrete or of other materials, should be so protected by heat insulating material that a load bearing member shall suffer no loss of strength by reason of the attainment of higher temperatures in a standard fire test of the duration prescribed for the class of construction for which it was designed.

After the War Problems from a Constructional Viewpoint

WHILE the great need for engineers after the war in reconstruction seems to be the prevailing conception, there no doubt will be business problems connected with his work which are of a most unprecedented character. The expenditure of large sums will be required to replace the ravages of war and the greatly depleted purchasing power of the European nations call for credit which will have to be extended by America, if business is to be established on a flourishing basis.

In an address given by Mr. W. S. Kies, vice-president of the American International Corporation before a recent meeting of publishers and manufacturers at Chicago, the need for optimism and of looking ahead in business problems was emphasized. It is the viewpoint of a United States citizen, thinking and speaking for his own country, but there are, nevertheless, many ideas of general and timely interest. Mr. Kies states that after the war is over there will be little opportunity in Europe for marketing merchandise other than that which will be absolutely necessary for re-habilitation purposes. Price fixing is a war measure; it is an artificial interference with the economic laws of supply and demand; its tendency, however, is to restrict production rather than increase it. Production in wartime is the all-important consideration, and is always stimulated by the possibility of profits. Excessive profits can always be taken care of by taxation. If, however, price fixing is successful in keeping down prices of necessities, and, at the same time, results in maintaining supplies sufficient for the nation's requirements, then we may well anticipate powerful support for a continuance of the practice after the war, even though the abnormal and artificial conditions which made for its success as a war measure shall no longer exist. Interference with fundamental economic laws always has in it the possibility of disaster. The laws of competition in the long run must determine prices, but the possibility of price fixing after the war, due to popular demand, is a factor with which business must reckon.

Profits to-day are limited as a result of price fixing and through excess profits taxes. When there is an overwhelming demand and the supply is inadequate, both price fixing and limitation of profits may be justified, on the theory that the hazard of finding markets for products and the business risk, due to possibility of over-production, is removed. In such a condition competition is no longer possible, and the producer has a monopoly with the power to make his own prices.

But after the war, when the problem of finding markets capable of absorbing our surplus production in this country will become serious, then price fixing and the limitation of profits will destroy business initiative and make commercial growth and expansion impossible. It is a plain fact, which the people and the politicians of this country must recognize, that the incentive to all business, the thing which makes possible the growth and expansion of a country, is the possibility of profits, and that any legislation which tends to restrict the earning possibilities and the reasonable profits of business is fatal not only to business itself, but to the continued development and the prosperity of the country.

May Have to Continue Control.

To what extent, after the war, will the Government continue to restrict our exports and imports? To-day nothing can be imported into or exported from the country without a license. This power is exercised in the interest of economizing shipping space, of checking the production of non-essentials, and of restricting the consumption of non-essentials, imported from other countries. When the war is ended tonnage will be plentiful and there will be no need for restricting the production or consumption of so-called luxuries, which, as a nation becomes more cultured and civilized, contribute largely to the pleasure and convenience of life. But a world condition may arise which will compel our

Government still to continue a large measure of control over the foreign commerce of the country. The belligerent nations of Europe will need raw materials. They will need steel, machinery and other supplies for rehabilitation purposes. Their gold supply has been depleted and their credit exhausted. So huge are expenses and so large the accumulation of national debts that Europe may be forced to adopt bimetallism, if not obliged to go on a paper basis altogether. The purchasing power of the belligerents will necessarily be restricted, and we may reasonably look forward to not only a limitation of imports on the part of the European belligerents, but the purchase of necessities by the Government itself or through strong central organizations under Government patronage.

England, for example, might purchase its cotton through a Government agency, or through an organization of cotton manufacturers. France might purchase needed steel and machinery for rehabilitation purposes through a central agency. If such a development should take place, then, to protect our cotton growers and our manufacturers it might be necessary for our own government to continue some form of governmental control over our exports and imports. Such a possible restricting of the free movement of our foreign commerce is a factor which will affect future business, because of the increasing importance of our foreign trade and the growing necessity of foreign markets to absorb our surplus production.

This country is to-day building ships at a rate which, if continued, will give us the largest merchant marine in the world. In 1914 we built but 7.1 per cent of the ships constructed in the world during that year. In 1918 it is estimated that we shall build in this country 48 per cent. of the world's tonnage, and in 1919 59 per cent of the ships to be built in that year.

No matter how the war ends, at its close we shall be the second, if not the first, ship-owning nation in the world. Will we again permit our merchant marine to dwindle to insignificant proportions as we did once before in our history after the war of 1812?

Without Markets No Prosperity.

The prosperity of every part of the country is closely dependent upon the prosperity of every other part, and the central West should be as vitally interested as the Eastern seaboard in the development of the means of carrying our foreign commerce. We manufacture and raise more than we can consume in normal times, and unless we can find and develop markets for our surplus products the country as a whole cannot be prosperous. In the upbuilding of this foreign commerce an efficiently operated merchant marine is a necessity.

Just before the war we placed upon our statute books a Seamen's Act which made it impossible for American ships, privately operated, to compete with the ships of other nations. For years our mercantile marine had been declining, and the Seamen's Act was the last blow.

A careful analysis of figures of cost of operation proves that before the war it was impossible to operate ships in competition with other nations which were not hampered by restrictive navigation laws. Even before the Seamen's Act was passed this differential in operating costs was sufficient to stop the increase of our marine. When the war opened there were under the American flag a mere handful of ships. The necessities of war demanded ocean transportation, and to meet the situation billions of dollars were placed at the disposal of the Shipping Board for the purpose of constructing and operating ships. The lack of tonnage, the tremendous demand, and high freight rates make it possible to operate now without consideration of operating costs. After the war this will be different. That the great merchant navy we are now acquiring will be operated goes without saying, but it is for the American people to decide the serious question of policy as to whether it shall be operated under private management, and have the benefit of private initiative, or whether it shall be operated by the Government.

If it is to be operated privately, restrictive legislation must be supplanted by constructive measures in aid of its maintenance. To compete with the rest of the world in ship operation, the conditions under which we operate must be equalized. If it costs more to build and operate ships in this country, and we expect to maintain our marine, then the difference in cost must be made up in some way. If the Government operates, this difference will be met by drafts upon the public treasury, as in the case of the Post Office. But do the people of the United States desire Governmental operation of our merchant marine? Are they sufficiently confident that such management will prove efficient and economical?

At the moment Government management may be successful, because in wartimes political favoritism is admittedly unpatriotic, and the great danger of politics and the building of a political machine through Government operation is less threatening. The best brains and highest managerial skill are at the command of the Government. Men to whom private corporations would readily pay thousands of dollars for the use of their ability are to-day in the service of the government without compensation, actuated by patriotism and a desire to serve in this crisis When the war is ended the government can no longer retain these men, and without them successful operation is imposible.

The future of our merchant marine is in the hands of the people; the policy to be adopted after the war is of serious consequence to this nation and should receive the careful, thoughtful consideration of every citizen.

The railroads of the United States were taken over by the Government, as a war measure, last December. It was rightly assumed that the wartime needs of the country in transportation could only be taken care of by the proper coordination of all the railroad lines of the country and their operation as one unified system, but the railroads were so shackled by state and national restrictions that this coordination under private management—however desirable—seemed impossible of achievement.

If unified operation results in economics, improvement in service along some lines and a profit to the Government, then imediately a strong campaign will be inaugurated to have the Government permanently retain control of the railroads, and the result of this campaign will be a factor of great importance in the future business development of the country. When the world crisis has passed the patriotic incentive will no longer exist. The best men in the railroad world will seek employment elsewhere because of restricted opportunities in the Government service. It is inevitable that the railroad labor unions will obtain larger and larger control of the railroads of the country, and that politics will dictate the appointment of high officials, the rate of wages, and the policy of extensions and service in different communities. The vast political machine which could be built up out of the railroad employees of the country, reinforced by the sailors of our merchant navy if this too were Governmentally operated, would be in complete control of the country.

What of Demobilization?

When the war is won, what of the problem of demobilization of our armies and of the reorganization of industry for the purpose of again taking up the pursuits of peace? Let me point out a few of the serious questions that will arise. The millions of men who have been fighting our battles will of right be entitled to their old places in commerce and industry. Will the women workers, who have tasted the fruits of economic independence and have earned large wages, willingly give up their places?

The workers of this country are receiving wages unheard of before in history. When the men released from war come into the labor market and the law of supply and demand begins to operate, will wages be reduced to a lower level in an orderly manner or shall we enter upon a period of labor troubles with attendant strikes and riots?

Our soldiers have been fighting the battles of democracy. The world is imbued with this idea, and the ideals of democracy, as put forth not only in Russia but in conservative England, contemplate the control of industry by labor. The movement in labor circles looking toward industrial democracy is deserving of most careful and sympathetic study by all employers, for it expresses a fundamental and powerful instinct of human nature which must be reckoned with. There is no getting away from the fact that we must face an adjustment between capital and labor after the war, and that, unless this situation is handled with the utmost intelligence and wisdom on the part of both the leaders of capital and labor, serious consequences will result.

If it be possible to turn the forces of production from war materials into peace-time production, and to find markets for all that we can produce, so as to keep our industrial machine going at top speed, then the problem will be less aggravated. But here again we must clearly face certain facts. The productive capacity of the country has increased during the last three and a half years. Large additions to our great industrial plants have been built. The output of this increased capacity must be sold in order to keep these plants going.

Little Opportunity in Europe.

After the war the purchasing power of Europe will be decreased. The belligerent nations have piled up huge debts. England's debt has increased from $3,458,000,000 to $27,636,000,000; France from $6,598,000,000 to $22,227,000,000; Italy from $2,792,000,000 to $6,676,000,000, and Germany from $1,165,000,000 to $25,408,000,000. The gold resources of Europe have been depleted. With national debts reaching staggering totals there will be difficulty in finding funds or arranging credits to pay for imports. In fact, the problem of the European belligerents will be to build up depleted gold reserves and shattered credits, and this can only be done by restricting the consumption of imported articles and by stimulating exports. Except, then for raw materials absolutely needed to feed her industries, and machinery and construction materials needed for rehabilitation, European markets will offer little opportunity. The surplus products of this country must, therefore, find their markets in neutral countries that have not been impoverished by war. But in these neutral markets we shall meet a keener competition than before the war because of Europe's necessity of rebuilding its financial strength through favable export balances.

Of course Europe's problem of demobilization will be even more exaggerated than ours, because of the more perfect organizations for war purposes, but Europe, particularly England and France, have learned lessons in industry as a result of the war whch will make their competition in neutral markets more keen. The United States and Germany, before the war, were the exponents of mass production. We know that England and France have shown marvelous development along these lines during the war, and it is safe to assume that after the war the same methods which have so wonderfully increased the munitions production of England and France will be used in the production of articles for international commerce, and by these methods they will be produced at a cost as low or lower than we can produce them here.

Competition in the world's markets is mainly on the basis of price. If the quality is practically the same the cheaper article will dominate a market. The cost of an article in commerce is mainly made up of the cost of capital, the cost of raw material, and the cost of labor. Improved scientific processes, skillful direction and intelligent labor may tend to decrease the cost, but the cost of labor is so large a part in the cost of most articles that, if it is out of line with labor in a competing country, the product suffers in competition in foreign markets. It seems inevitable, therefore, that if industry is to be kept prosperous in this country our foreign commerce must be maintained, and to do this production must be continued on a basis that will enable us to compete. This may of necessity mean lower wages as a last resort, but every effort to bring down the cost of production should first be made. Labor must be taught that its interests lie in intelligently aiding in increasing the results of its labor, which would help to bring down unit costs. Labor, on the other hand, has the right to demand the most skillful and intelligent management. Organization of our industries along the lines of cutting down useless expenses, eliminating wasteful competition and combining for the purpose of the purchase of raw materials, the marketing of goods, and the extension of credits will put our industries in a stronger position to compete against the world.

Foreign business after the war, in spite of the many difficulties, holds promise of large volume. The neutral countries of the world have been shut off from their European sources of supply, and the shelves are empty. Needed improvements and developments, both public and private, have been postponed until after the war. Many of the neutral countries prospered as we did and are in a position to buy for cash or on short credits when shipments are possible. On the other hand, the undeveloped countries of the world have been obliged, for lack of capital, to pause in their development.

We Must Extend Credit.

Europe must have credits for raw materials, and for the machinery and construction materials needed for rehabilitation. This means that we must develop in this country a market for foreign securities. We are much better equipped to extend credit and to take advantage of foreign business possibilities than we were before the war. The wealth of our country has increased, and we have sources of credit information which did not previously exist. Branches of our national banks have been established throughout the world.

One other favorable factor which we must not overlook, and which gives cause for confidence in the future in spite of the many serious problems to be faced, is the great addition to the sum of knowledge of world business which we have obtained, and the shaking off of our provincialism in the development of a broader international viewpoint. We know more about the peoples of the world, their characteristics and their national ideals than we did before the war. We have sensed our international obligations and have developed a feeling of world citizenship. Our country stands before the world as an unselfish exponent of the highest ideals of democracy, and as an example of national sacrifice to our sense of right and duty to the world. The magnificent work of our Red Cross has created respect for our abilty to do things, and has inspired a feeling of gratitude and affection for the American people. In the years to come prejudices which affected our business relations in other countries will be removed, and it is safe to say that our relations, both commercial and public, with the nations of the world will be on a much more friendly basis of understanding in the future than in the past.

Putting War Cripples Back on the Payroll

Much has been said and written regarding the plans of the Dominion Government to help war cripples to secure remunerative employment in spite of even the most serious wounds or other injuries, but, though Canada is conceded to be far in advance of all other Allied countries in the work of reinstating her maimed heroes, comparatively few people have seen actual evidence of the miracles being wrought for the men by specialized vocational training and physical reconstruction. This will be remedied at the Canadian National Exhibition, where, it is said, at least fifty men who have been restored to full usefulness will demonstrate how the soldier beneficiaries of the Government's rehabilitation programme have been made economically self-supporting. Included will be a number of blind men, who have been re-educated and are back on the civic payroll. The men will demonstrate some 15 industrial processes, including typesetting, oxy-acetylene welding, jewelry manufacture, lens grinding, assaying, etc.

Provincial Roads Taken Over by the Ontario Government

Hon. Finlay Macdiarmid, Minister of Public Works and Highways, announced yesterday that the Government had decided to take over the Prescott-Ottawa road and the section of the main highway between Napanee and Kingston, on Aug. 15. He also announced that the Government would assume control of the Queenston-Grimsby Road. This is a continuation of the policy announced some time ago in designating the road from Port Hope to the Quebec line a provincial highway—the Toronto-Port Hope section having been taken over a year or more ago. Some work will be done this summer, chiefly of a preliminary nature, cutting out of ditches, etc., in addition to a certain amount of repair surfacing where necessary. On the Ottawa-Prescott road it is estimated that this year's expenditure will be in the neighborhood of $50,000.

The route of the Ottawa-Prescott road runs easterly from Prescott along the River Road to what is locally known as Johnstown, thence northerly through Edwardsburg Township to Spencerville, continuing northerly through the village of North Gower, thence diagonally through the second concession to Lot 5, thence easterly through Waterson's Corners to the Rideau River. From there it turns northerly through Manotick, following the Rideau through the Township of Nepean to a point adjacent to Fisher Avenue, Ottawa. The exact Ottawa entrance will be determined at a later date.

Advisers to Administrative Commission

With a view to securing economical and efficient work the Administrative Commissioners of Montreal have appointed Mr. Charles Garrett and Mr. A. E. Doucet, civil engineer, Quebec, to advise on contracting and engineering work. The appointments are temporary. Mr. Garrett will report on the contracting work, and Mr. Doucet will be consulted on engineering. The former has been engaged on railway work in West Africa, and has also carried out railway construction contracts in Ontario, Nova Scotia and Quebec. He was formerly connected with the Sudbury Dynamite Works and the Hamilton Powder Co. Mr. Doucet, who is a member of the Engineering Institute of Canada, was at one time district engineer for the Transcontinental Railway, and chief engineer of the Lake St. John Railway.

After July 31, 1918, the firm of MacKinnon, Holmes and Company, Limited, will be known as the MacKinnon Steel Company, Limited.

Mainly Constructional

East and West—From Coast to Coast

Work has been started in Regina, Sask., on the new Lakeview public school.

It has been decided to build an addition to the Beach School at Hamilton, Ont.

Work on a new pumping station at Sault Ste. Marie, Ont., will be commenced immediately.

Extensive repairs to the city sidewalks and pavements have been commenced in Regina, Sask.

The Brock Woolen Company, Brantford, Ont., are building another addition to their factory, 42 by 156 feet.

Alterations and additions are proposed for the Port Colborne post office. Tenders have already been called.

The Winnipeg Builders' Exchange second annual picnic was held at Grand Beach recently, the attendance being over 1,200.

Building permits in Toronto for the first half of July totalled approximately $300,000, and included 40 residential buildings.

The Ford-Smith Machine Company, Hamilton, Ont., have taken out a permit for the erection of a factory building to cost $30,000.

Work has commenced on a temporary bridge at Glen Road, Toronto, to connect the Bloor Street Viaduct with Parliament Street.

The council of the township of York propose the installation of a quantity of 6-inch cast iron water mains, together with valves, hydrants and other equipment.

The farmers in the district of Burgessville, Ont., have under proposal the building of a cheese factory. J. H. Cohoe is president of the local association.

Tenders will be called by the Surrey Council, Cloverdale, B.C., for a proposed road leading from the Pacific Highway to the plant of the Liverpool Canning Company.

Sir John Eaton has taken out a permit for a brick and concrete central heating plant, with underground tunnel, to be constructed at his home on Spadina Road, Toronto.

The bridge over the Credit River at Port Credit, Ont., will be replaced with a new structure, it is anticipated, this summer. This is on the Toronto-Hamilton concrete highway.

The National Abrasives Company, lately of Hamilton, are busy with their new works at Renfrew. The Hamilton Bridge Company are taking down the steel structure at Hamilton for re-erection at Renfrew.

Jos. Villeneuve, Limited, have been granted Quebec letters patent. The principal place of business is at St. Romuald, Que., and the capital stock $40,000. The company are empowered to carry on a general contracting business.

Work has begun on the Wade property at New Liverpool, Que., to fit the coves out for extensive shipbuilding operations to be carried on by the Federal Shipbuilding Company, of Sarnia, Ont., who will construct ships for the French government.

Work has been started on macadamizing the short stretches of road at the ends of the bridges on the Toronto-Hamilton Highway. This macadam is only temporary until new concrete bridges are constructed, when the roadway will be concreted throughout.

Tenders have been received for a new heating plant for the court house and annex at Hamilton, Ont. It is estimated that with a new system approximately 100 tons of coal per year would be saved, although the cost of such a system is deferring action.

Recent Winnipeg building permits include a new front to the Province Theatre, $25,000; an addition to the city light and power station on McFarland Street, $19,000; a new warehouse for the Globe Bedding Company, $25,000; and an addition to the Rye Flour Mills, $26,000.

The Colborne street concrete roadway, Brantford, Ont., laid in 1916, is rapidly going to pieces, having been laid without city supervision. It is claimed that an insufficient quantity of cement was used and that it will be necessary now to coat it with asphalt as the only means of preserving it at all.

The Winnipeg city council have ordered the laying of new water mains for the distribution of water from the Shoal Lake pipe line to the pumping stations. The mains to be immediately proceeded with are those to connect well No. 6 in Elmwood and well No. 5 in the north end, and also the main station on Keewatin Street.

The Canadian Northern Railway have a number of men engaged in preparing the site for their new station at Rainy River. The building is to be of red brick, with stone facing, and the roof will be of metal. The structure will be 130 feet long by 30 feet wide, two storeys. Hardwood floors will be provided throughout. Work is also progressing rapidly on the new ten-stall addition to the roundhouse.

The lowest bid submitted for the work of constructing an intercepting sewer to connect Ford, Walkerville and Windsor, is $163,573, which does not include cost of erecting pumping station and equipping it with the necessary machinery. Estimates for this work made two years ago by the Essex Utilities Commission, placed the cost at approximately $210,000, but since that time the constantly advancing level of materials and higher wages demanded by labor has resulted in an increase of almost $100,000 over the original estimate. It is now not unlikely that the work may have to be postponed until after the war.

On August 15 the provincial government will take over the Ottawa-Prescott Road, a distance of 56 miles, but the exact entrance to Ottawa has not yet been decided upon. On the same date the 25 miles of road between Napanee and Kingston and the Hamilton-Queenston road will also be taken over by the government. Repair work will be undertaken and all necessary regrading and resurfacing of the roads to bring them up to standard will be started as soon as the roads have been taken over. Wherever possible, the roads will be widened and made ready to convert into provincial highways. The Prescott-Ottawa road passes through North Gower, Johnston, the Village of North Gower and the Village of Kentville.

The city of Montreal will undertake the completion of the La Salle bridge, work to commence immediately. Machinery and materials of the contractors, Pion and Grothe, will be used. These were seized by the city when the contractors failed to proceed with their contract. The contractors waited on the city commissioners recently and asked the city to pay for the work already done, amounting to about $80,000. They suggested that the city might hold the money that was placed on deposit, $25,000, and pay them the balance, which would be $55,000, and in consideration of the city agreeing to do this it was agreed to take $50,000 cash. The city, however, refuse to see the point. The contract called for the construction of the bridge for $250,000, the city to take over the work and charge it to the contractors if the contractors defaulted. The city will endeavor to have the work completed by next summer.

Town-planning and housing needs are being given attention in several cities. The town-planning board of Hamilton have the matter under consideration, and also the city council of Toronto. Dr. Hastings, medical health officer, Toronto, has submitted a fifteen page report in which he says that the Dominion Government should follow the example of the United States in loaning $400,000 to every $100,000 advanced by the city for the construction of workmen's houses. Rentals, he said, should never exceed 20 per cent. of the worker's earnings and the great need was for houses of this type. The difficulties of the present, in the way of all such housing schemes, seems to be that of financing, there being practically no demand for second mortgages owing to the working of the moratorium act. A lengthy editorial in the Vancouver World recently called attention to the urgent need for town planning as a means of the conservation of money and health. The Industrial Committee of St. Thomas have under consideration providing municipal housing for the employees of industrial plants.

Obituary

William Langford, a well-known Peterboro contractor, died recently after a short illness. He was 72 years old and had for some time served on the local council.

Frank Gutteridge, a prominent Sarnia building contractor, died recently after an illness extending over a year. He was senior partner in the firm of Gutteridge & Grace and went to Sarnia from Seaforth several years ago.

John Calbick, pioneer contractor, New Westminster, B.C., died recently in his 80th year. He had been a resident of the city for over fifty years and had served on the council and school board. He was born in Brantford, Ont., and went to New Westminster in 1860, the journey taking fifty days via the Isthmus of Panama.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Boischatel, Que.
Private tenders will be called shortly for the construction of a $10,000 water system for the Citadel Brick & Paving Block Co., Ltd., 42 Dalhousie St., Quebec. Hamel & Tessier, 51 St. Pierre St., Quebec, are the engineers.

Brampton, Ont.
Tenders are being received by the clerk, A. G. Davis, until 6 p.m., August 5, for the reconstruction of a sewage disposal plant for the Town Council. Plans and specifications are with the engineer, W. M. Threadgold.

Burnaby, B.C.
The Department of Public Works & Municipal Council contemplate resurfacing roads at a cost of $20,000. Engineer, A. E. Foreman, Victoria.

Guelph, Ont.
The City Water Commissioners contemplate the installation of an auxiliary pumping machine costing about $16,000. Engineer, F. McArthur.

Osgoode Township, Ont.
Tenders are being received by the clerk, F. Iveson, Metcalfe, until 3 p.m., August 6, for the construction of drainage costing $3,350 for the Municipal Council. Architects, Magwood & Stidwell, Cornwall.

Scarboro Township, Ont.
Tenders are being received by the engineers, James, Loudon & Hertzberg, Excelsior Life Bldg., Toronto, until August 2 for the construction of sidewalk, curb and gutter on Queen Street for the Township Council. Clerk, W. D. Annie.

Sombra Township, Ont.
Tenders are being received by the clerk, W. A. Scott, Wilkesport, until August 12 for the construction of a $20,000 drainage system for the Township Council.

Sutherland, Sask.
Tenders are being received by the secretary, R. C. Desrochers, Ottawa, until August 16 for the construction of water supply system for the Department of Public Works, Dominion Government.

Toronto, Ont.
Tenders are being received until August 6 for plumbing, heating, hydraulic plungers and freight hoist for pumping station work for the Board of Control. Secretary, Thos. McQueen.

York Township, Ont.
Township Council contemplate the construction of watermains on a number of streets at a total cost of $69,780. Engineer, Frank Barber, 40 Jarvis Street, Toronto.

CONTRACTS AWARDED

Merritton, Ont.
Loraza & Lebio and McLaughlin Bros. have the general contract for sewers costing $12,000, for the Municipal Council.

Winnipeg, Man.
The American Well Works, Aurora, Ill., have the general contract for pumping unit for the City Council.

York Township, Ont.
The Grant Contracting Co., Ltd., 50 Front Street E., have the general contract for the construction of a watermain on Kenwood Avenue for the Township Council.

Railroads, Bridges and Wharves

Bayfield, Ont.
Tenders are being received by the secretary, R. C. Desrochers, Ottawa, until August 7 for rebuilding of South Pier at a cost of $25,000, for the Department of Public Works, Dominion Government.

Brant and Haldimand Counties, Ont.
Tenders are being received by the Deputy Superintendent General, Duncan C. Scott, Ottawa, until noon, August 4, for the construction of culvert and steel bridge in Tuscarcora Indian Reserve for the Department of Indian Affairs, Dominion Government.

Montreal, Que.
Work will start shortly on the completion of the La Salle bridge, costing $250,000, for the City Council. Engineer, Paul Mercier.

Victoria, B.C.
The Department of Railways, Dominion Government, Ottawa, have secured site for railway terminals.

Yamachiche, Que.
Tenders are being received by the secretary-treasurer, A. O. Bellemare, until August 5 for the erection of a steel bridge for the Municipal Council.

York Township, Ont.
Plans and specifications are with Mr. Frank Barber, consulting engineer, 40 Jarvis St., Toronto, who will receive tenders until August 3 for the construction of a concrete bridge on town line between townships of York and Vaughan.

CONTRACTS AWARDED

Dufferin, Man.
Robert McQueen, Carman, has the general contract for two bridges for the Municipal Council.

St. Pascal, Que.
Hyde & Sons, 43 Common St., Montreal, have the steel contract for reinforced concrete bridge over Poivirers Stream for the Town Council.

St. Philemon, Que.
Goubin & Beachemin, Dalhousie St., Quebec, have the general contract for $12,000 concrete bridge for the Town Council.

Simcoe County, Ont.
B. Dorsey, Beeton, has the general contract for bridge over Bailey's Creek for the County Council.

Swan River, Man.
J. W. Campbell, Carman, has the general contract for two bridges for the Municipal Council.

Twigges Island, B.C.
The Empress Construction Company have the general contract for the construction of a bridge from here to Lulu Island for the Department of Public Works, Dominion Government.

Public Buildings, Churches and Schools

Canora, Sask.
The erection of a $4,000 isolation hospital is contemplated by the Waddell Memorial Hospital. Address, Rev. Dr. Young, Presbyterian Home Mission, Saskatoon, or Rev. J. A. Hackney, Canora.

The Presbyterian Ruthenian Congregation contemplate the erection of a $6,000 girls' home. Address, Rev. Dr. Young, Presbyterian Home Mission, Saskatoon, or Rev. J. A. Hackney, Canora.

Halifax, N.S.
Ross & McDonald, Sackville St., have been appointed architects and tenders will be called shortly for the erection of a hospital for the City Council.

Loverna, Sask.
Tenders are being received by the secretary-treasurer, L. P. Monson, until noon, August 22, for the erection of a frame school for the Springville School District No. 2697.

New Westminster, B.C.
Plans have been prepared for refrigerating plant for the Royal Columbia Hospital.

Oak Bay, Victoria, B.C.
The Oak Bay School Board, Municipal Hall, are having plans prepared for school improvements costing $10,000.

Port Moody, B.C.
City Council contemplate the erection of a $3,000 addition to school. Clerk, J. J. Tye.

Renfrew, Ont.
The trustees of the General Hospital contemplate the erection of a General Hospital. Rev. W. M. H. Quartermaine is interested.

St. Maurice, Que.
The Roman Catholic Congregation are having plans prepared for a $6,000 two-storey frame sacristy. Architect, Thos. Raymond, 45 Caron Street.

Toronto, Ont.
St. John's Anglican Church, St. John's Road, have secured a site on which they will erect a church. Pastor, Rev. R. McNamara, 289 Annette Street.

The British Imperial Association will

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Guarding Equipment with Trained Dogs

ON almost any contracting job there is always a certain amount of small equipment strewn about the site. When the time comes to collect this material a good deal of it has disappeared; to overcome this difficulty a St. Paul contractor has enlisted a number of dogs into his service.

The dogs are tied by long, light chains to trolley wires so placed that it is not possible for a prowler to reach any article of value without encroaching on the beat of one of these sentinels.

The instruction of an Airedale for watch dog duty of this kind is begun when the puppy is about six months old. It does not take these intelligent dogs more than a month to learn the "business," and they are at their prime when they reach the age of three years. This does not mean, however, that they are not useful for several years longer. It is said that since the idea of using these dogs to guard plant has been tried out much pilfering of small articles, such as picks, shovels, wheelbarrows, boiler fittings, etc., has been stopped. One harrowing experience with these very earnest watchmen is a great plenty for the average petty thief.

The only drawback about these dog guardians is that their method is to "shoot first and investigate afterwards." They make slight distinction between friend or foe when they find a prowler, and in more than one instance workmen who had gone back to the job after some article which they had forgotten have been fiercely attacked by the watch dogs.

One watchman with several well-trained dog assistants can take care of a large quantity of equipment and the expense would be much less than if several men had to be employed.

Speed the Peat Industry

WHILE the fuel question is by no means solved, reports indicate an improvement in the situation both as to increase of production and transportation of coal. There is reason to believe that, although the most stringent terms of economy are necessary, there is no cause for worry from a coal famine this coming winter. It was thought probable at one time that the peat industry would thrive and supplement coal, but at the slow rate of progress being made there is now no chance of help before the winter of 1919. The government states that the work is held up for probably a year because of the inability to procure the necessary machinery. No doubt there are great difficulties to overcome, but according to statistics, the peat industry in the United States has increased 420 per cent. in ten years.

In Europe 15 to 20,000,000 tons of peat are consumed annually for the generation of heat and power. There were 18 plants producing peat in 1917 and the average price received for peat at the point of consumption was about $7.30 per ton. It is said by proper productive methods the price can be reduced to $2.50 per ton. In the face of these figures the peat industry is one of great importance to Canada, since enormous areas of this material are available. The peat in an undrained swamp contains up to 90 per cent. of water which must be reduced to about 30 per cent. before a good fuel is produced.

Aeroplanes for Fire Ranging

SOME attention has already been given to the subject of the probable use of aeroplanes for fire-ranging, and that they will be of immense service in this new field seems altogether likely. The chief difficulty of the fire-ranger is that of detecting fires when they are at a stage when it would be safe for him to travel into the area in order to extinguish the blaze. At present the ranger is hampered by having to tramp through timber where it is impossible to see forty or fifty yards in advance, owing to the thick growth in our northern districts; his scope of observation when on the trails is limited—he might pass within a hundred yards of an old smouldering camp fire without noticing it, whereas if he were above it, although he would no doubt be inconvenienced by the thick foliage, there would be a greater chance of locating the trouble.

Probably the greatest difficulty in regard to aeroplane patrol would be that of securing a suitable place to land. That these landings would have to be made on water is perhaps the only solution apart from that of clearing certain landing sites in the range to be patrolled.

Whether the use of aeroplanes might not also be applied to preliminary and certain kinds of survey work is open for investigation. In laying out roads through bush areas, the aeroplane would be able to furnish with great speed information as to the nature of the country, and this would prove a valuable aid in choosing the most economical route in regard to heavy timber cuttings, etc. After a certain line has been cut, it is often later noticed that if it had been offset or carried around certain rough stretches a considerable saving could have been effected.

In other words, the engineer at present has to look at topography in elevation, which limits his view or requires endless tramping, the turning of angles, etc., before he can place the project before the eye of the prospective investor. Doubtless the aeroplane would be of great assistance to the engineer when used as an auxiliary instrument for viewing the distinguishing topographical features which govern the site of certain engineering structures for power and other purposes.

Comparative Costs of Building

A WRITER in the "Building Age" attempts a comparison between the cost of building, in 1916 and 1918, a simple workman's cottage, and figures the increase at 26 per cent. Here is how he figures it out:

House, 24 x 26. Cellar Wall of cement blocks.

	1916	1918
Cost of excavation and cellar wall	$250	$300
Concrete bottom of cellar	60	75
One coat patent plaster throughout the house	85	100
Lathing, labor only	15	25
Hardware, nails, hinges, locks, etc.	40	75
Plumbing, fixtures, kitchen sink, range boiler, laundry, toilet, bath	200	300
Lumber, windows, inside finish Georgia Pine; clapboards, No. 1 Pine; all lumber and lath	850	1,000
Material and labor on chimney—cellar to top	30	40
Slag roofing, three-ply	35	50
Paint for two coats; labor	35	60
Varnish and labor; two coats inside	25	35
Labor—carpenter and helpers	500	600

The writer continues: I obtained a bill of material from the owner and builder. In figuring up the quantities I find the total cost at 1916 prices would have been about $2,125.

"I have taken prices given by a lumber company on this house in 1916 and on the same in 1918. The prices on the largest items, the material, practically agree with those which I give. For further data I have taken the prices given by a mail order house in 1916, and again in 1918 on a number of houses, and find the advance average some 26 per cent. Labor, masonry work and material will have about the same rate of increase, therefore I believe we can call this about the actual rate of increase in the cost in the last two years.

According to a recent report, another important advance has been made in the shipbuilding industry. The first steel vessel built without rivets, has just been launched on the south coast of England. The production of this vessel marks an epoch in shipbuilding, the plates being fused together by electric welding. General adaptation of this process, would speed up production, with an estimated saving of from 20 to 25 per cent. in both time and material.

Canadian Industrial Reconstruction

AT a general meeting of the Canadian Industrial Reconstruction Association, recently held in the Molsons' Bank Building at Montreal, the following recommendations, submitted by the Executive Committee, were approved:

(1) That in order to stimulate national unity and in recognition of the advantages of a good understanding between Quebec and the English-speaking Provinces five scholarships in French for students from the English Provinces be established in Laval University and five scholarships in English for students from Quebec in the University of Toronto, and that in connection with such courses the English students be maintained for one year in France and the French students for one year in Great Britain.

(2) That the Association by appeal and argument encourage groups of industries which have common problems to follow the example of the Tanners, the Textile Industries and the Pulp and Paper Makers in order that through co-operation in scientific research, in processes of manufacture and in methods of marketing the advantages of large capital and practical experiments may be obtained and greater economy and efficiency in production assured.

(3) That the Association by appeal to financial and industrial interests and private capitalists and to the Federal and Provincial Governments, endeavor to have Graduate Research Faculties established in the Universities of McGill and Toronto, where training can be had equal to that secured in the great American Universities. It seems to be clear that such Faculties will be a vital requirement when the National Research Institute is established by the Dominion Government. If the industries are to avail themselves fully of the facilities for research which it is the intention of the National Advisory Council for Scientific and Industrial Research to provide the Universities must supply the trained experts to conduct necessary experiments.

(4) That a postgraduate scholarship or fellowship be offered in the departments of economics of McGill, Toronto and Manitoba Universities, successively, open to women graduates of any Canadian university, for the purpose of carrying on research work of an economic character in the industrial or home-making occupations of women.

(5) That a matriculation scholarship be offered at various Canadian universities, open to girl matriculants from high schools, collegiate institutes and women's colleges, for the best essay on the economic importance from the National Standpoint of household buying or on the training of girls for skilled employment.

(6) That by arrangement with the Ministers of Education in the different Provinces, prizes be offered for essays by school children on national industries or on the value of trade training in finding advantageous employment.

(7) That the Executive Committee of the Association consult with Hon. Frederic Nicholls, with the object of assisting in the movement which he has inaugurated to interest the Dominion Government in the vital problem of export markets and in organizing the industries of the country for an efficient partnership with the Administration in finding, extend-

ing and developing trade in other countries, particularly during reconstruction in Europe, in confidence that such trade once secured will be held to the common advantage of Canada and the other countries concerned.

(8) That the Association through its Executive Committee endeavor to arrange for a Conference with the Mayors of Western town and cities with the object of obtaining more accurate knowledge of conditions in the Western Provinces, the extent and character of their natural resources and the opportunities for establishing new industries or branches of Eastern Industries in favorable locations.

(9) That delegates representing agriculture, the commercial and industrial interests and the universities and newspapers of Western Canada be invited to visit the industrial communities of Eastern Canada, as the guests of the Association, with the understanding that an invitation to members of the Association to visit the West would be accepted and that the sole purpose of such deputations should be to acquire more exact knowledge of national conditions and problems.

(10) That the Association try to arrange conferences with Railway Brotherhoods and the Great War Veterans' Association for mutual consideration of problems of reconstruction and to ensure co-operation as far as may be found practicable between the business interests and those bodies, in devising and supporting measures which may seem to be necessary to maintain stability and prosperity.

(11) That the Association undertake to organize or co-operate in the organization of a National Conference to consider primary education in relation to the duties of citizenship and to which distinguished educationists from Great Britain and the United States would be invited.

(12) That the Executive Committee have a pamphlet prepared, showing what steps are being taken in other countries to improve relations between employers and workmen and what regulations or agreements affecting particular industrjes are being tested or are under consideration.

(13) That the Association issue an appeal to employers and industrial companies to have conferences with their workmen in order that the staffs of manufacturing and other business enterprises may have fuller knowledge of conditions affecting raw materials, available markets, the character and the degree of competition to which they are exposed and the problems of readjustment when peace is restored.

(14) That the Executive Committee also have pamphlets prepared for publication in newspapers or periodicals or by direct publication under the auspices of the Association as may be convenient or desirable on the following subjects:—

(a) Democracy and Public Credit; (b) Lessons of the French Revolution; (c) Irresponsible Government in Russia; (d) Combination, Co-operation and Efficiency; (e) Debt and Taxation Before and After the War; (f) Relation of the Banks to Agriculture, Industry, and National Development; (g) Waste in Local Works and Public Buildings; (h) Sources and Incidence of Taxation in Canada and the United States; (i) British Agricultural and Commercial Policy; (j) The Relation of Wage Earners to Japan and the United States; (k) State Aid for Industry; (l) Federal and Provincial Assistance to Agriculture in Canada; (m) Advantages of Local Markets; (n) Farm products Produced, Exported, and Consumed in Canada; (o) The National Advantage of importing factories and exporting finished products; (p) The partnership of women in industry; (q) The Home, the Shop and the Factory; (r) Taxation of Incomes and Profits.

Sir John Willison is president of the Association and Major A. N. Worthington, secretary.

Mechanical Rapid Sand Filtration Plant for Dorval, P. Q.

THE town of Dorval, P. Q., near Montreal, has just put into operation a mechanical rapid sand filtration plant, the plans for which were drawn by Mr. J. A. Roy, of Dupont, Roy and Baudoin, consulting engineers, Montreal.

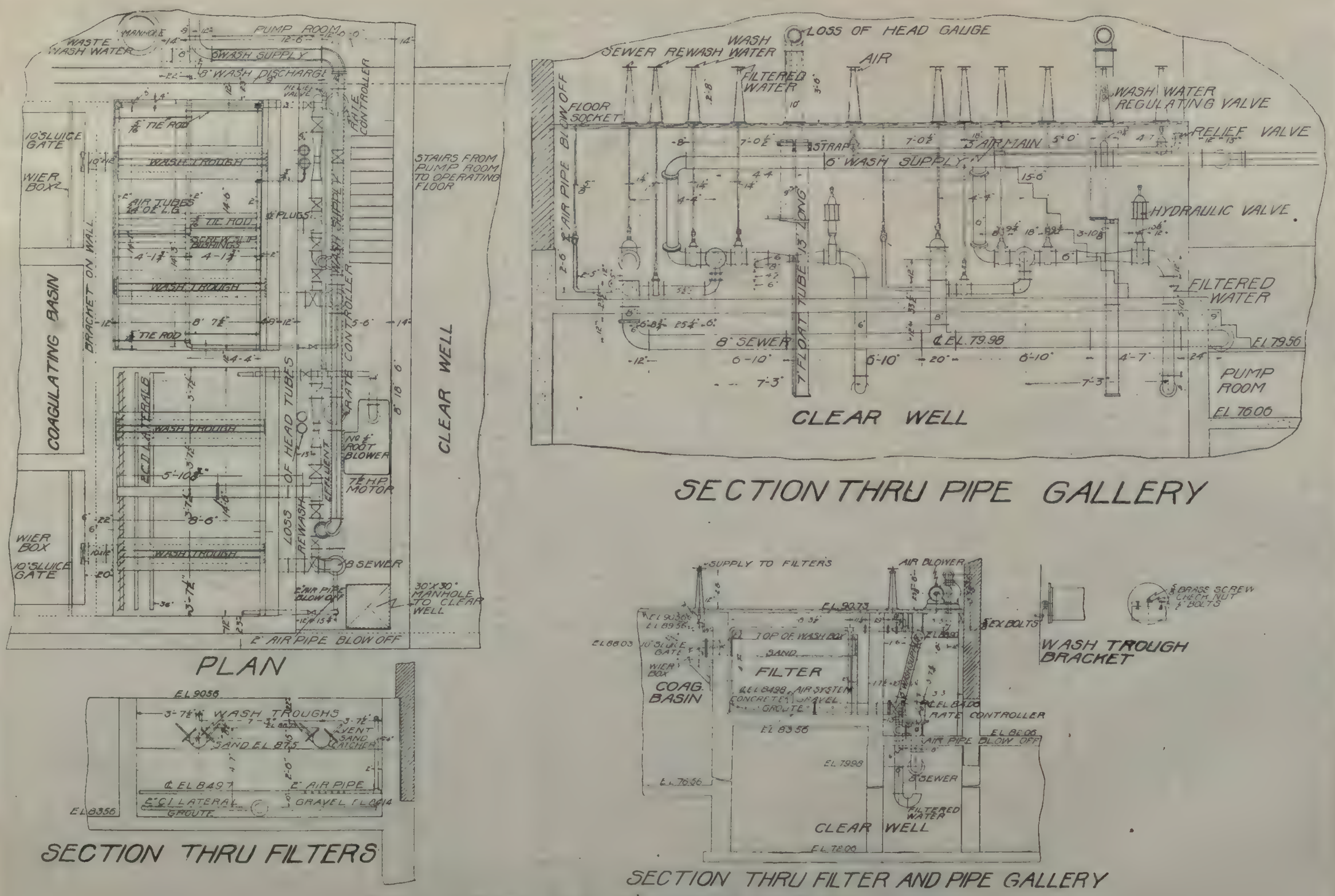
The plant comprises two filter beds, with a total capacity of 500 U. S. gallons per minute; a coagulation basin of 80,000 gallons; and a clear water well of 100,000 gallons, besides which there is an elevated tank for storage purposes. The water is taken from the St. Lawrence, and the suction main is connected with both high aud low lift pumps so that in the event of anything going wrong with the filters, the town can still be supplied with water.

Before the installation of the filters, the water was treated by the chlorination process, and this is still utilized as an extra precaution. The apparatus is located in the old pumping house, which also contains the high service pumps.

The new plant is housed in a two storey building 33 x 47 ft. with an extension 15 x 14.6 ft., in which are placed the two new low lift pumps, this extension communicating with the old pumping house. The building is of reinforced concrete up to 4 ft. above ground, with 12 in. brick walls resting on the concrete. The coagulation basin is 13 ft. deep, constructed of concrete, and extends 2½ ft. below ground level. The clear water basin is excavated to a depth of 6½ ft. and extends some distance beyond the exterior of the building, and is covered with 2½ feet of earth to prevent freezing. It is constructed of concrete 12 in. thick, while the roof is supported by concrete columns. The coagulation basin is covered with 3 in, planks, forming the operation gallery. The filter beds, each 8 ft. 6 in. x 14 ft. 6 in., with a total filtering area of 250 sq. feet, are to the right of the operating platform. The pipe gallery adjoins the filter beds and is 1½ ft. below the beds. The chemical tanks are placed on the operating floor, and are reached by a stairway.

The low lift pumps are located in the extension, this room being 4½ feet below the ground. Adjacent is a concrete wash water reservoir containing 5,000 gallons.

The upper portion of the filter building comprises the engineers' quarters. The ceiling of the first floor



Details of Filter Plant just installed for Dorval, Quebec.

is of asbestos. The roof of the building is tar and gravel, and that of the extension asbestos shingle.

Each filter is equipped with a manifold and strainer system, consisting of a 6 in. main collector pipe running across the bottom of the filter. The strainers consist of 20 three-way and 250 two-way Wilson patent strainers, allowing the water to pass through at a velocity of 1½ feet per second. The air for washing is supplied by a Roots blower giving 500 cubic feet per minute, and is located in the old pumping station. It is directly connected to a 1130 r.p.m. Westinghouse motor.

Two 12 in. cast iron inlet and overflow troughs are installed in each filter. These allow the water to be distributed over the filter beds and also carry off the dirty water after the filters have been cleaned. The troughs have concrete sand catcher boards and vent pipes to prevent the sand from washing away. The rewash water is discharged into a concrete tank through an 8 in. iron pipe, and from there is carried into the sewer.

Venturi tube rate controllers with hydraulicly operated controlling valves are connected with the effluent pipes of the filters. A master controller and operating valve is placed on the operating floor, this enabling the rate of filtration to be changed from 50 per cent below to 50 per cent. in excess of the rated capacity of the filter. Loss-of-head gauges are mounted on an iron stand on the same floor. The flow from the coagulating basin to the filter beds is controlled by a 10 in. Chapman circular gate valve operated from the operating floor, while the wash water and rewash water gate valves are also operated from here.

The concrete chemical tanks for the coagulant have the usual equipment of agitators, driven by a one h.p. motor direct connected to a set of reduction gears with sprocket chains; dissolving boxes, chemical solution filters, blow-off pipes, orifice tanks, etc.

The pumping unit consists of a low lift double suction split shell pump, with 5 in. suction and discharge pipes, made by the St. Lawrence Pump and Engine Co., direct connected to a 7½ h.p. 3 phase 220 v. 60 cycle motor, and a 7½ x 10½ x 12 Deane duplex piston pattern pump, the latter being used as a standby. Both pumps have a capacity of 500 gallons per minute, under a total head of 30 ft.

Mr. J. O. Meadows, consulting engineer, Montreal, has made a test of the plant. He reports that the test was satisfactory. The filter water was well clarified, the bacterial removal being good taking into consideration the very low germ content of the raw water at the time of the year. A sample of the filtered water taken 8 hours after starting the filters did not show the presence of hydrate or suspended matter, after being held for 12 hours.

The general contract was let to Mr. Arthur Bastien, Montreal, at $35,300. The mechanical equipment was supplied by the Norwood Engineering Co., of Canada, Cowansville, P. Q., of which Mr. H. W. Hosford is manager.

Easing and Super-Elevating the Highway Curve

WITH the advent of motor vehicles and heavy motor truck transportation systems it is certain that we shall have to give more attention to the layout of highway curves. On account of the extra cost it has not been the universal practice of highway engineers to eliminate curvature as much as possible in choosing a road location. However, just as the railroad locating engineer must confine the degree of curve within well defined limits, so should the highway engineer avoid curves which limit unnecessarily the "sight distance." Although the demands which govern the design of railroad lines differ in some instances from highway work, yet the increasing weight and speed of vehicles is bringing to the front certain features, (well known in railroad work), which may be of great service on the highway curve. We refer to the subject of super-elevation and easement curves.

The spiral or easement curve is used in railroad location to make the change of direction from the tangent to the curve more gradual in order that the car wheels may more easily adjust themselves to the changing alignment. Rules are laid down governing the length of spiral necessary for certain degrees of curvature and are commonly expressed as a function of the super-elevation, e.g., 60 feet of spiral for every inch of elevation of the outer rail. The degree of curvature of the spiral increases from zero at the B. S. to the same degree of curvature of the main curve, to which it is joined at the E. S. Although it is not absolutely necessary to spiral a highway curve as is the case with the railroad curve yet the problem of increasing sight distance in order to eliminate collision in many instances may be solved to some extent by inserting a spiral, or easement, curve.

It is true that the greater flexibility of the motor truck in changing direction, as compared with the trucks of a railway coach, to some degree, remove the need for providing an easement curve in the highway, but the easement curve enables the locating engineer to keep as near to the straight line principle as possible and with this important point in view the extra time spent in locating a spiral on our road curves seems to be justified by both the greater ease in turning and the appearance of the curve in the landscape.

Super-Elevation of the Highway Curve.

Another important factor in highway design, and one which was formerly considered necessary in railroad work only, is that of super-elevation. In railroad work the outer rail on a curve is elevated above the grade on the tanget to offset the tendency of the train to continue in a straight line when travelling at high speed. As in the easement curve, rules are laid down for the amount of elevation required for each degree of curve. In practice, the section foreman, by observing the effect of wear on the rails, determines whether his outer rail is too high or too low. If too high the inner rail wears more rapidly than the outer rail, and vice versa. When the rails wear equally the elevation is correct, under existing conditions.

Although in the highway curve the conditions are somewhat different, yet on a narrow crown the motor follows one track on the road surface to a large extent and where heavy trucks are concerned some means is necessary to prevent all the wear on one side of the road surface. Judging by present indications it is possible to foresee the introduction of trucks of a carrying capacity and weight which were hitherto unthought of and, with this important point in view, it seems opportune now to provide every means possible to distribute the traffic uniformly over our road surfaces by providing adequate super-elevation on curves and to ease the curvature as much as possible.

DEGREE OF CURVE

100 FT. EASEMENT

DISTANCE FROM BEGINING OF EASEMENT

OFFSET

SUPER-ELEVATION

FT.	2°	4°	6°	8°	10°	12°	14°	16°	18°	20°	20°	22°	24°	26°	28°	30°	32°	34°	36°	38°	40°	40°	42°	44°	46°	48°	50°	52°	54°	56°	58°	60°	FT.
110													80 FT. EASEMENT									12.75	13.41	14.07	14.74	15.41	16.08	16.76	17.44	18.12	18.81	19.50	110
100																						8.82	9.27	9.72	10.17	10.62	11.08	11.54	12.00	12.46	12.93	13.40	100
90			60 FT. EASEMENT								4.37	4.81	5.25	5.69	6.13	6.58	7.02	7.47	7.92	8.37	8.82	6.23	6.55	6.87	7.19	7.51	7.84	8.16	8.49	8.82	9.15	9.48	90
80											2.80	3.08	[illegible]	3.64	3.92	4.20	4.48	4.76	5.04	5.33	5.62	4.48	4.71	4.94	5.17	5.40	5.64	5.87	6.10	6.34	6.58	6.82	80
70	.28	.56	.84	1.12	1.40	1.68	1.96	2.24	2.52	2.80	1.89	2.08	2.27	2.46	2.65	2.84	3.03	3.22	3.41	3.60	3.80	3.33	3.50	3.67	3.84	4.02	4.20	4.37	4.54	4.72	4.90	5.08	70
60	.15	.31	.47	.63	.79	.94	1.09	1.25	1.41	1.57	1.27	1.39	1.51	1.64	1.77	1.90	2.03	2.16	2.29	2.42	2.53	2.43	2.55	2.67	2.80	2.93	3.06	3.19	3.32	3.45	3.58	3.71	60
50	.09	.18	.27	.37	.47	.56	.65	.74	.83	.93	.86	.94	1.02	1.11	1.20	1.29	1.37	1.46	1.55	1.64	1.73	1.65	1.73	1.81	1.90	1.99	2.08	2.16	2.24	2.33	2.42	2.51	50
40	.05	.11	.17	.23	.29	.34	.39	.45	.51	.57	.52	.57	.62	.67	.72	.78	.83	.88	.93	.99	1.05	1.06	1.11	1.16	1.21	1.27	1.33	1.38	1.43	1.49	1.55	1.61	40
30	.03	.06	.09	.12	.15	.17	.20	.23	.26	.29	.29	.32	.35	.38	.41	.44	.47	.50	.53	.56	.59	.60	.63	.66	.69	.72	.75	.78	.81	.84	.87	.91	30
20	.01	.02	.03	.05	.07	.08	.09	.10	.11	.13	.13	.14	.15	.16	.18	.20	.21	.22	.23	.24	.26	.27	.28	.29	.30	.31	.33	.34	.35	.36	.38	.40	20
10			.01			.02			.03				.04			.05			.06			.07					.08			.09		.10	10
0	2°	4°	6°	8°	10°	12°	14°	16°	18°	20°	20°	22°	24°	26°	28°	30°	32°	34°	36°	38°	40°	40°	42°	44°	46°	48°	50°	52°	54°	56°	58°	60°	0
10			.01		.01	.02		.02	.03	.03	.02					.02	.03				.03	.02	"	"	"	"	"	"	"	"	"	.02	10
20			.03	.04	.06	.07	.08	.09	.10	.11	.06	.07	.08	.08	.09	.09	.10	.11	.11	.12	.13	.08										.08	20
30			.08	.10	.13	.15	.18	.20	.23	.25	.14	.16	.17	.18	.20	.21	.23	.24	.25	.27	.28	.18										.18	30
40			.13	.18	.22	.27	.31	.36	.40	.45	.25	.28	.30	.33	.35	.38	.40	.43	.45	.48	.50	.32										.32	40
50			.21	.28	.35	.42	.49	.56	.63	.70	.39	.43	.47	.51	.55	.59	.63	.66	.70	.74	.78	.50										.50	50
60			.28	.37	.46	.55	.65	.74	.83	.92	.56	.62	.68	.73	.79	.84	.90	.96	1.01	1.07	1.13	.72										.72	60
70	.10	.20	.30	.40	.50	.60	.70	.80	.90	1.00	.77	.84	.92	.99	1.07	1.15	1.23	1.30	1.38	1.45	1.53	.99										.99	70
80											.94	1.04	1.13	1.22	1.32	1.41	1.51	1.60	1.70	1.79	1.88	1.30										1.30	80
90											1.00	1.10	1.20	1.30	1.40	1.50	1.60	1.70	[illegible]	1.90	2.00	1.65										1.63	90
100																						1.91										1.91	100
110																						2.00	"	"	"	"	"	"	"	"	"	2.00	110
FT.	2°	4°	6°	8°	10°	12°	14°	16°	18°	20°	20°	22°	24°	26°	28°	30°	32°	34°	36°	38°	40°	40°	42°	44°	46°	48°	50°	52°	54°	56°	58°	60°	FT.

Table of offsets and super-elevations for easement curves.

The accompanying table and diagram of super-elevations and offsets for easement curves are used by the highway engineers of King County, Washington, in the construction of paved roads. The tables are the outcome of the experience of the engineers with existing tables which did not appear to give sufficient elevation to properly accommodate traffic. Roads are now being built with curves laid out in accordance with these tables and they appear to be giving satisfaction to all who are using them.

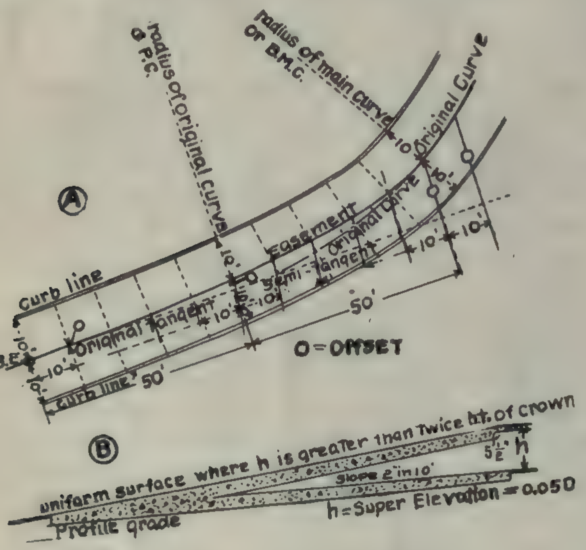


Fig. 1—Diagram for easement curves.

The super-elevations given are based upon an empirical formula:

H=.05d; where H=the super-elevation of a 20-ft. roadway in feet, and d is the degree of curve.

This formula was used for curves up to 40 deg. and, as will be noted, by reference to the table, curves of a greater degree than 40 have the same elevation, as it was felt that to carry this formula to extremes would result in an embankment so steep it would be dangerous to vehicles standing on the road or to horses walking.

The easements are used to provide a transition from the tangent to the main curve as indicated in A. & B Fig. 1., and the change from the regular section of the pavement to the full super-elevation is made entirely within the limits of the easements.

It will be noted that the casement is not a true spiral, as at the point where connection is made with the main curve the radius of the easement is bound to be somewhat less than that of the main curve.

It is believed that the tables are self-explanatory, but the following example of an application is given:

Assume that the main curve is one of 30 deg. and it is desired to find the proper data to lay out the super-elevation and the easement.

Enter the table along the center line showing the degree of curve. The amount of offset from the tangent will be found in the column immediately above corresponding to the distance from the beginning of the easement shown in the left-hand column, while the super-elevation for a 20-ft. roadway is indicated immediately below, the distance from beginning being indicated in the left-hand column as before. Tabulated data for a 30 deg. curve are given in the following table:

30-deg. Main Curve—80-ft. Easement—20-ft. Roadway.

Beginning of Easement, in Feet	Offset from Tangent, in Feet	Super-elevation H, in Feet
10	.05	.02
20	.20	.09
30	.44	.21
40	.78	.38
50	1.29	.59
60	1.90	.84
70	2.84	1.15
80	4.20	1.41
90	6.58	1.50

It should be noted that one-half of the easement is laid off on the the tangent before reaching the beginning of the original curve.

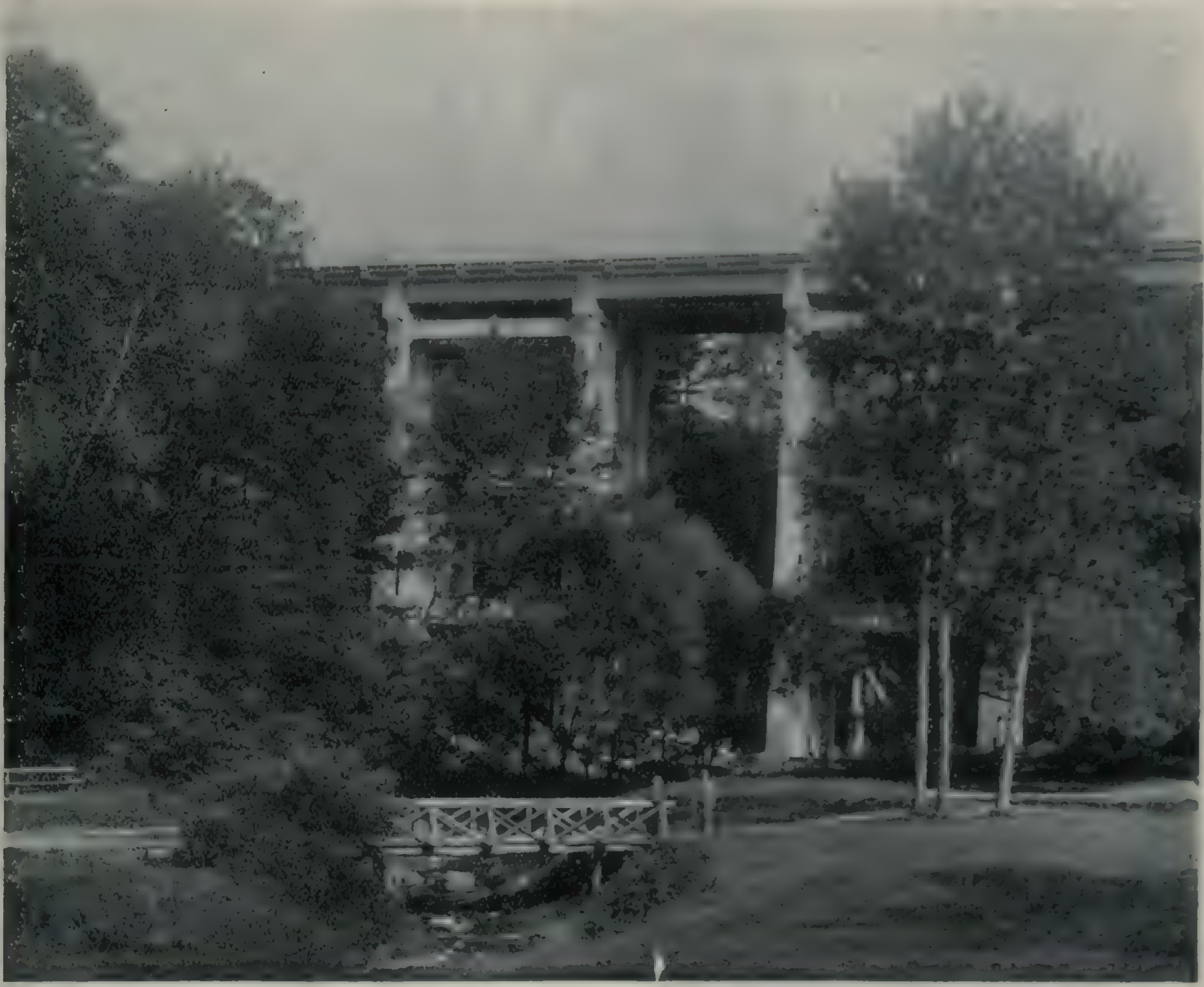


Fig. 1—Artistic concrete bridge over Reservoir Ravine, Toronto, just completed by C. P. Railway Company.

New C. P. R. Viaducts at Toronto

THE double tracking of the North Toronto subdivision of the Canadian Pacific Railway, between Leaside and North Toronto is now nearing completion, and involved the replacement of bridges (known as 0.9 and 1.8) which heretofore had been trestles constructed of steel. The work of erection of the new bridges has been described from time to time during the past year in the Contract Record, notably in the following issues: August 22, 1917, page 711; November 7, 1917, page 917, and April 3, 1918, page 261.

Owing to the high price of steel and the difficulty of procuring it since the war began, it was decided to use reinforced concrete. The bridges were, therefore, constructed of this material and are a triumph of railway construction work, No. 0.9 being 386 feet long and 90 feet high, carrying two tracks, and No. 1.8 of similar dimensions, but a three-track structure. The length of the individual spans and the details of their construction are believed to be unprecedented in the engineering world. Previous to this no reinforced concrete beam with a length of more than 25 feet, has been attempted; the spans of these two C.P.R. structures are each from 35 to 37 feet long. These spans have been made possible by the employment of unit construction, by which each span was designed as two T beams, which, after being manufactured near the work, were laid side by side on the previously built reinforced concrete towers. The towers themselves are really reinforced concrete buildings constructed in the usual manner by means of wooden forms built around a steel reinforcement which was previously assembled and securely wired together. This work was done during the winter, at a time when the temperature was below freezing point; it was performed inside of what was virtually a building erected to maintain a suitable temperature around the newly deposited conncrete until it was out of danger of damage by frost.

These two structures are provided with narrow sidewalks, and hand rails which enable trainmen to move conveniently alongside standing trains. The hand rails add considerably to the aesthetic appearance of the structures which are artistic in appearance, and at the same time satisfactory from a general and utilitarian point of view, besides being absolutely permanent. Both are designed to carry the heaviest engines in existence with a considerable margin of safety. The two structures are so solid that when passing over them on a train one gets the impression that he is on a solid fill instead of a bridge.

The method employed in the erection of the reinforced concrete spans is a specially interesting feature of the structures. Each slab, as a unit, weighed 55 tons, which was the limit load that could be handled by the C.P.R. 100 ton standard wrecking cranes. The crane engaged handled 110 slabs, each 55 tons in weight, or in all, something like 6,000 tons, and all this was done without a single mishap to either men or material. The method of placing these slabs was described in detail in the "Contract Record" of April 3, 1918, p. 261. Another remarkable feature is that both structures were built without interruption from the beginning of June, 1917, to the beginning of July, 1918, which was a shorter period than would have been required to manufacture and erect similar structures in steel. Passenger and freight traffic on the C.P.R. main lines was continued without interruption over temporary wooden trestles during the progress of these interesting works.

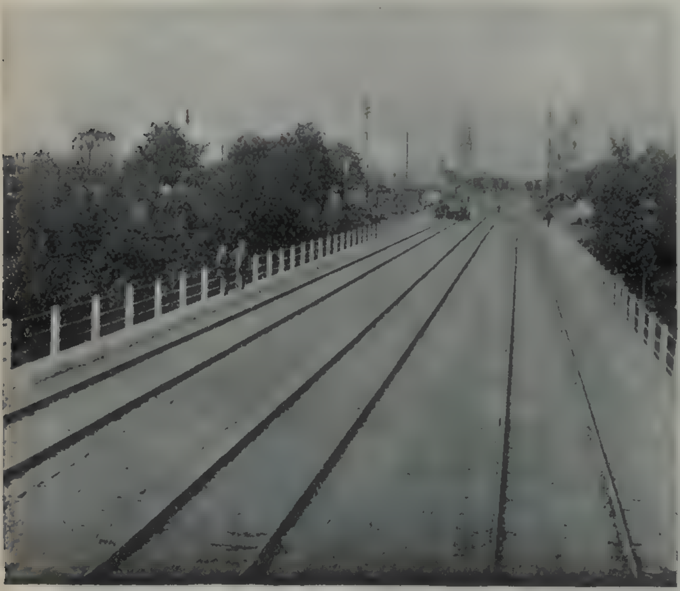


Fig. 2—A view of the bridge floor—looking west.

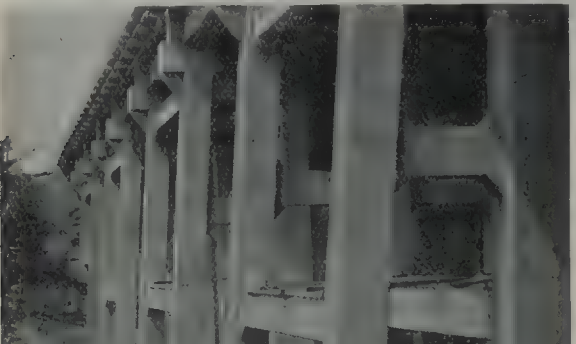
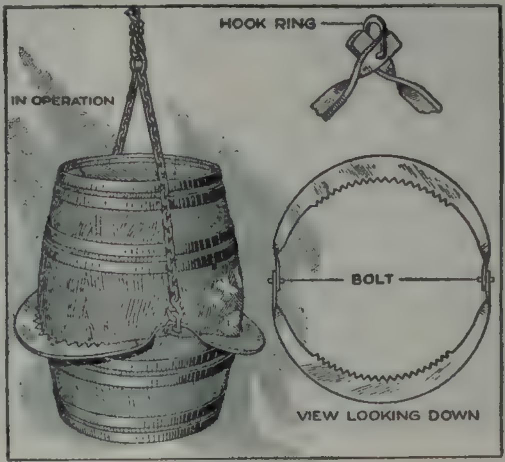


Fig. 3—Understructure of C. P. R. Viaduct.

The photographs herewith show the most recent views taken of the bridge near Yonge street. Fig. 1 shows a view with the reservoir ravine as a background; Fig. 2 is a view looking west into the new North Toronto station, and Fig. 3 is a close-up view of the concrete understructure.

Clamp for Lifting Barrels With a Crane.

WHERE it is necessary to lift a number of barrels on a large construction job the clamp shown in the cut is very useful. Although the device may be constructed of materials of a dimension in keeping with the requirements of the work in hand, cold rolled steel ⅝ inch thick will be found adequate for lifting the ordinary 50 gallon barrel. The operation of the clamp is similar to a pair of ice tongs and when once dropped over the body of the barrel it will not slip. A considerable amount of time and labor may be saved by using this clamp in preference to picking up the barrels with nets and end hooks.



Repairing Rubber Pump Valves.

An easy method of repairing rubber pump valves which have become worn is described by Mr. T. Ryan, in "Coal Age":—

It is not uncommon for practically new valves to develop such large holes that the efficiency of the pump is much reduced by the escape of water. To overcome this, the valve is taken out and the hole punched somewhat larger than desired. A plug cut from a discarded valve is then pressed into the hole with rubber cement. This leaves a blank valve in which a new hole of any desired size can be punched When this bushing becomes worn, it is easy to remove it and insert another. It is possible to bush valves to fit worn spindles in this way, and keep the spindles in service for a long time after they would ordinarily be discarded.

The Armstrong Cork Company, Pittsburgh, Pa., are distributing a little publication on Nonpareil Insulating Brick for furnaces and ovens. Copies may be had on request.

Safe Water Standards—Necessity of Impressing Consumer with Value of Pure Water

THERE is little doubt that the water consumer judges the purity of his supply largely by its appearance and taste. If water is colorless it is accepted as being pure, while on the other hand, turbidity denotes impurity and the presence of matter in suspension; nevertheless the clear sample may contain disease producing bacteria, while the turbid one may contain altogether harmless ingredients.. The importance of bacteriological analysis should not be underestimated and means should be taken to impress the consumer with the fact that water should not be judged by its appearance only, and as urged in a paper before the Chemical and Bacteriological Section of the American Waterworks Association, by Mr. William Orchard, universal standards of purity should be adopted:

Whether or not we are governed by arbitrary or tentative standards, more or less definitely fixed, those who in the course of their work are called upon to interpret large number of bacteriological analyses, unquestionably are governed by standards that they have set, upon which the interpretation is based, and this interpretation is made, first, without reference to a sanitary survey; and, second in conjunction with a sanitary survey to determine, if possible, the sources of any apparent pollution. But these personally established water standards vary with the individual's interpretation of the analyses.

A water showing coli in 0.1 c. c. regularly will unquestionably be condemned, as will also, without doubt, a supply usually showing coli in 1 c. c.

A water showing coli frequently in 5 c. c., and occasionally in 1 c. c., will very likely be rejected by most sanitarians, although the frequency with which such supplies are furnished to consumers, without rigorous steps being taken to improve the quality, is surprising.

When we reach a water, however, with coli present frequently in 10 c. c. quantities, and occasionally in smaller amounts, the interpretation of the analysis lies very largely with the individual, and the supply may be rejected or passed in accordance with the individual's standards.

The Consumer's Standard.

The water standard set by the consumer is for the most part of appearance. If a water is not turbid or colored, he is usually satisfied. Unless his immediate family has been vitally touched by the effects of an impure water supply, he is not solicitous about the quality of the supply. The complacent and erroneous impressions that many water consumers have in reference to their supplies must be eliminated by careful, painstaking publicity and education. In discussing water supplies of various communities with non-technical men and water consumers, one is frequently advised that the water supply is the purest in the country; that it is 99.9 per cent pure; or, that it is well water that never sees the light of day and is absolutely safe. The individual cannot be blamed for resting secure in these assertions, for he does not know better.

Most of those present at this meeting, in going into a strange city or town, do not drink the water furnished until the nature of the supply has been ascertained. Many of us abstain from drinking water when on road trips, even in territories where other liquid refreshments are not easily obtained, simply because we appreciate the pollution that a water may carry and the danger that may lurk in a tumblerful. The average consumer, however, seldom gives this matter a thought because his training has not taught him to do so.

Typhoid Kills Too Many People.

A more complete and masterful presentation of the value of pure water than that contained in Johnson's paper, "The Typhoid Toll," was probably never presented before any association. In it, the author says that more people are killed every year by typhoid fever than by railroads. The water consumer will stop and look before he crosses a railroad track. We must make him stop and think before he drinks a glass of water.

Necessity of Publicity.

A pure water supply is a good dollars and cents business proposition; why not treat it as such? Why not pattern our conduct as a water works association after that of a successful business organization? Are we not all of us, water works superintendents, engineers, chemists, bacteriologists, manufacturers, or what not, offering our services and our product, water, to our final customer, the consumer? Being honorable men, we want to give him the best that he will pay for, and he will only pay for the best when he is educated to its need. With the consumer educated and demanding the best in water supplies, there will be no further danger from the non-technical, disinterested, or slovenly water works vendor, for he will not be pemitted to do business.

Looking at this matter, then, as a business proposition, seeking to find a market for a water supply of higher standards than most of those at present furnished, should it not be approached in the same manner as any successful business campaign? Given a good product for which there is a market, the success of any business depends on bringing the product to the attention of those using it, and that can only be done by advertising and publicity. Why not have this association act as an advertising or publicity medium to obtain higher standards on the part of the technical and non-technical water works man and also the consumer? Begin with the consumer; advertise to him the value of better water so that he will demand the best, and be willing to pay for it. Then he will get it. Are we not lacking in the fulfillment of the highest objective of this association unless we endeavor by every means at our disposal to educate the general public as to the value of pure water?

Let us suppose that graphic illustrations of the value of pure water were to be incorporated in every public health exhibit in the country were to be made part of travelling exhibitions; to be incorporated by the Boards of Education in instructions given in school rooms, and disseminated by every educational medium. It would not be long before the demand for better water would be so insistent as to cover the entire country.

Advertise Necessity of Pure Water.

And with the objective of creating this demand on the part of the consumer, and thus offsetting the deleterious influence of the careless water vendor (and to support the technical water works man in the promulgation of higher standards of water supplies) this suggestion is offered: that this association appoint a committee to consider the feasibility of a joint board to consist of four members, these four men to appoint a publicity or press agent, who might well be one of the secretaries or editors of those associations, whose sole duty would be to spread the propaganda of better water supplies. There are many problems presented; the cost of broadcast publicity at first would be prohibitive but intensive advertising campaigns could easily be conducted in certain localities.

This is a tremendous undertaking, but unquestionably it is worth while. It is a campaign which would take years to properly cover the country, and it is not to be expected that the tangible results would be immediate. That the end to be accomplished is a good one is beyond dispute, and in aiding to spread the gospel of pure water, this association will fulfill its highest function.

Is Wood a Suitable Material for the Construction of Mill Buildings?

By W Kynoch, B. Sc. F.E., and R. J. Blair, B. A.*

THE Forest Products Laboratories have frequently had occasion to draw attention to the serious financial losses resulting from the ravages of so-called dry rot in mill or factory buildings of wooden construction. Numerous cases in which this trouble has occurred in Canadian buildings have been carefully investigated and one of these, which has been under observation for upwards of a year, affords a typical example of a deplorable state of affairs which could have been entirely avoided had those concerned in the erection of the building been guided by the necessary knowledge of the technology of timber and the mechanism of the decay of wood.

From the point of view of the owners of the building the facts are as follows: Five years ago a large factory building was constructed with heavy timber columns and beams and laminated floors of 2 in. x 6 in. planks overlaid by ⅞ inch hardwood. The timber was only partially seasoned when installed. The operations carried on in the building are such that the relative humidity in the interior is usually high. Serious decay was first noted about three years after the erection of the factory, and since that time has apparently become steadily worse. The tearing out of practically the whole of the timber construction has now become imperative and such is the prejudice against wood as a structural material which has been created in the minds of the owners that they have decided to replace entirely with reinforced concrete, at an estimated expenditure of $100,000.

From a technical standpoint some additional important facts present themselves. The decay of wood is due to the action upon it of low forms of plants known as wood-destroying fungi and bacteria. For practical purposes the bacteria may be ignored. The germs of decay are no more inherent in timber than tobacco is inherent in a tobacco-pipe; infection must come from outside and sound wood becomes infected in two ways, namely, by contact with either tissue or spores of a wood-destroying fungus under suitable conditions of temperature, moisture and air supply. It should be noted that this is not merely an interesting theory. It is a hard fact proved beyond dispute by extensive research and thousands of carefully conducted tests, and we can now induce decay in timber at will in the laboratory. A number of kinds of fungi which can be definitely identified are responsible for the destruction of timber in buildings. In the particular case under discussion the range of temperature and relative humidity of the air in the factory were such as to provide exceedingly favorable conditions for the growth of several of the most destructive kinds. In addition the unseasoned state of the timber facilitated decay because it was not even necessary for the wood to absorb water from the humid air before reaching the moisture content permitting the action of the destructive agent—the moisture was there already. Lastly, a large quantity of the timber used was of the character shown in Fig. 1—that is to say, of rapid growth and low density. Different pieces of wood, even of the same species, differ in their ability to resist attack. Fig. 2 shows timber of slower growth and higher density and possessing much greater resistance to wood-destroying fungi. What occurred, therefore, was that timber of low resistance in a condition to invite decay (i.e., unseasoned) was placed in a building in which the operations to be carried on gave rise to very favorable conditions for the growth of several extremely destructive kinds of fungi. It is therefore obvious that it could have been predicted that in all human probability decay of the timber would occur.

No Mystery About It

Such instances, and they are numerous, raise two important points for the consideration of the building lumber trades. Firstly, they bring wood into serious disrepute as a structural material. Secondly, they do not simply happen without warning, like an earthquake, nor are they due to some mysterious and unknown cause. The cause is known and the trouble can be prevented by proper procedure. Wood initially sound will last for an indefinite period so far as decay is concerned, if any one of the factors essential to the growth of fungi is lacking or can be effectively controlled. The moisture factor is especially important. If the required amount of moisture is present in the wood the fungi can grow in it. If it can be kept thoroughly air-dry their growth is absolutely prevented. It is, of course, rarely practicable under ordinary conditions to control the moisture content of the wood, the humidity of the air, temperature or air supply. The food supply of the fungus, however, that is, the wood itself, can readily be controlled in that by efficient impregnation with a suitable preservative it can be made chemically impossible for the fungus to act upon it. In the particular mill with which we are now concerned the conditions were so exacting that the timber should without doubt have received efficient preservative treatment.

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* Forest Products Laboratories of Canada.

The selection of the preservative to be used for the treatment of timber for a mill or factory building should depend on the circumstances of the particular case. A material which has been employed in several cases in Canada and the United States, known to the Laboratories, is mercuric chloride (corrosive sublimate). This preservative has been in commercial use to a rather limited extent for many years for the treatment of timber for various purposes, both in Europe and on this continent and has given excellent results.

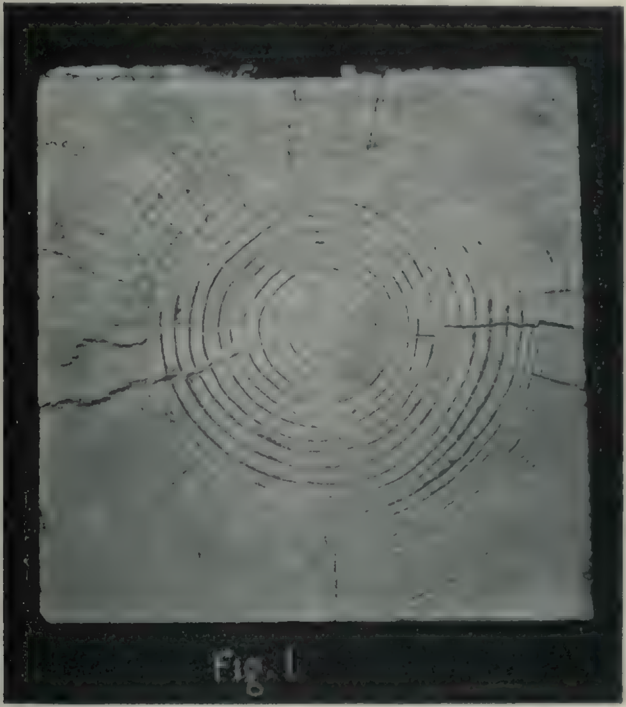


Fig. 1

Before the war several concerns of which the writers have knowledge treated timber with mercuric chloride for use in their own mill buildings, at a cost of about $3.00 per thousand feet B.M. The price of the preservative has since advanceed so greatly, however, that it might in some cases prove prohibitive at the present time. Other less costly preservatives which might be used are zinc chloride and sodium fluoride. The Laboratories would be glad to furnish, on request, further particulars regarding the use of these materials for the treatment of timber for mill buildings. Timber to be treated with preservatives should always be thoroughly air-dry. Treating green or very wet wood is time and money wasted, as little or no penetration of the preservative can be secured. In the case of large structural timbers, which frequently take years to become seasoned, the outer inch at least should be reasonably dry before treatment.

In mill or factory buildings or parts of the same, where the operations carried on create very favorable conditions for the growth of fungi, the use of untreated timber, especially timber of low density, or timber containing much sapwood, is inviting disaster. If the timber be efficiently treated, however, there is no objection to the presence of a considerable proportion of sound sapwood or to the use of sound second quality or low density wood, provided that where necessary due allowance be made for the lower strength of the lighter material. The added cost of treatment could therefore in some cases be partially offset by using less costly timber.

It must not be inferred that treatment of timber for mill construction is always necessary. It is only requisite where the conditions are especially exacting. In other cases the use of timber of the proper quality and the observance of certain precautions will give reasonable assurance of immunity from decay. The following precautions, some of which would require modification in individual cases, have been mentioned by the Laboratories on previous occasions, but will bear repetition here.

(1) Only dense material of the more durable species should be used, and the proportion of sapwood allowed should be small.

(2) The timber should be carefully inspected as to soundness, density and proportion of heartwood, and material not up to specifications should be rejected.

(3) Planking should be thoroughly seasoned in all cases. In large timbers the outer inch at least should be reasonably dry.

(4) Timber delivered on the work should be piled out of contact with the soil and with any unsound wood.

(5) All reasonable and practicable precautions should be taken to keep the wood as dry as possible before and during construction.

(6) Laminated floors should not be built while the wood is wet. If this is unavoidable it is advisable to proceed as follows: As soon as the building is completed and the heating plant installed, close all doors and windows, raise the temperature inside the building to, say, 120 degs. F., or as near this as possible, and maintain this condition for several days. If this can be done before building paper, pitch or hardwood flooring is applied over the laminated flooring so much the better. (In the case of storage or other buildings not provided with heating plants it is suggested that some temporary means of heating might be used

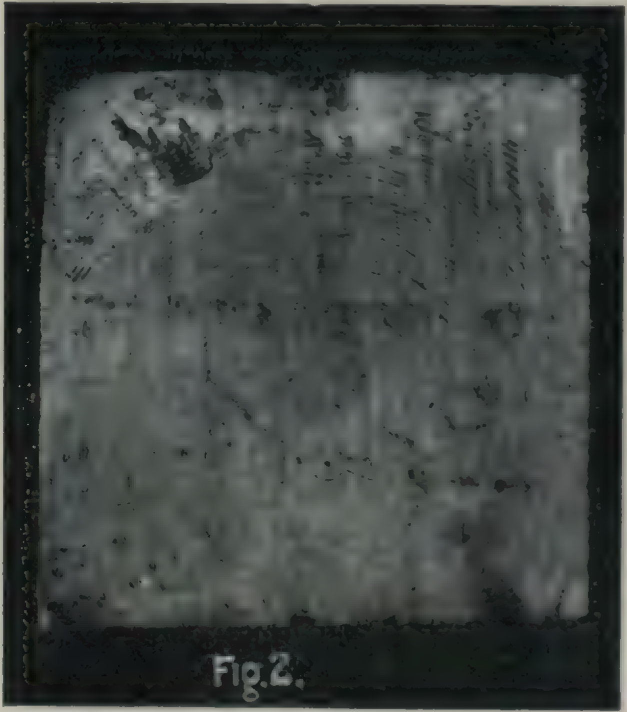


Fig. 2.

Where this is not feasible it would be safer to build with treated timber).

(7) Wood should not be covered with plaster or other materials or painted until at least two years after the building has been occupied.

(8) Construction at joints, where beams enter walls, etc., should be such as to permit of ample ventilation.

(9) Special care should be taken in the construction of roofs when untreated timber is used. It is necessary to have the interior roof planking thoroughly insulated so as to prevent condensation of moisture on it in winter.

(10) An examination of the planking and timbers should be made periodically, say half-yearly, during the first three or four years after the completion of the building.

That timber frequently becomes infected in the lumber yard and that trouble from decay in mill buildings often arises from the installation of such infected timber is beyond question. Where infection occurs in the lumber yard it is usually due to the existence of conditions which foster the growth of fungi, such as the following:

(1) Location of yard in a damp low-lying situation or neglecting to provide proper drainage.

(2) Allowing decaying waste wood to accumulate in the yard and to form centres for the distribution of infection.

(3) Using partially decayed foundation timbers for lumber piles, whereby disease is transmitted to sound lumber piled on same. (Foundation timbers should preferably be thoroughly impregnated with creosote oil).

(4) Piling lumber too near the ground, thus retarding circulation of air where it is most needed and keeping timber in the lower part of the piles in a favorable condition for infection.

(5) Using diseased spacers in lumber piles.

(6) Permitting diseased timber to remain as part of permanent structures in the yard.

Timber possesses several important advantages over other materials for interior construction in mill or factory buildings. For example, the initial cost is appreciably lower, alterations and extensions can be more easily and cheaply effected, construction can be completed in a shorter time and conditions are frequently more conducive to health and therefore to efficient work on the part of employees. Lower insurance rates can be secured for a sprinklered building of the standard mill construction type than for so-called fireproof buildings not protected by sprinklers. The only serious objection to the use of timber for this purpose is its tendency to decay and as we have endeavored to show the cause of the disease is known and preventive measures are neither difficult nor costly.

The Manifold Uses of Paint in Warfare

NOT only does paint play an important part in the preservation of building materials from weathering effects but the valuable service which it is giving in the army renders it almost indispensible. The uses of paint in warfare are almost innumerable. It is used as a means of identifying different kinds of shells, as they lay in almost limitless rows behind the lines, as well as to protect them against the corrosive influence of sea air and water. In this instance the paint must be free from lead so that if any of the contents of the shells come in contact with the paint, no explosive salts will be formed with the consequent complications and danger. As a means of baffling the enemy's observation scouts in regard to the location of batteries, important cross roads, etc., it has played an important part. The Russian Cossacks, early in the war, painted their horses to blend with the landscape coloring. While it would be impossible to enumerate all the uses to which paint is applied in warfare, the following article by Mr. M. G. Debonnet, in the Painters' Magazine, enunciates many instances in which paint is playing an important part in the present great war.

Officers teaching the firing of rifles, etc., to novices are furnished with painted "designation targets" for indoor instruction. These are about 12 ft. x 15 ft., and are representative of such bits of landscape as may be under fire by machine gunners, an advancing battalion or a battery of field pieces. The targets have a somewhat stereoscopic effect, giving the sensation of distance between the various objects represented, and are of the greatest value in training city men and others unfamiliar with country landscape.

Luminous paints are put to many ingenious uses, all due to the discovery that the persistent activity of radium, which, for example, when used in combination with zinc sulphide, gives rise to a lasting luminous effect readily discernible in darkness.

More than 150,000 marching compasses are in daily use by the Allied Armies, each fitted with a luminous radium dial, readable in the darkest night. Linen tabs coated with this paint are attached to the backs of the soldiers' coats, so that when the first line of men "go over the top" they will not be mistaken for enemies by the second following line of men. Tapes dipped in luminous paint are also used at night. They are securely laid on the ground in the daytime and used by soldiers as an illuminated road, any obstacle being provided with cross bands or arrows made of the same material.

Luminous discs visible at a distance of 50 feet are used for trench signalling to cover dangerous openings, etc., and are also made use of for showing the wounded the location of medical officers' tents and dug-outs. Guns have circles and points painted with this daylight paint to render them usable and efficient at night.

Luminous Lamp Posts.

Luminous paints of the old style, like Balmain's are also used over there for coating the street lamp posts, the purpose being to help the people to distinguish the unlighted posts in the darkness of the night. The curbs have been whitewashed for the same reason, it having been found rather practical to have the streets darkened at night to make them invisible to air raiders. Sometimes only a luminous band is painted around the bases of lamp-posts.

Zeppelins have been painted black, except on top, which was the colour of greyish silver, like the belly of a snake. In 1916 some of them were coated with aluminum paint. In one of the most recent raids on Paris conducted by the latest type of German aeroplanes the canvas wings were painted black, violet and dark blue. Aeroplanes are painted blue so as to merge in the colour of the sky, but while the colors may be deceiving, one cannot paint out the noise created by the driving machinery. Railings, roofs, etc., are painted all sorts of hues to resemble the variegated colors of the ground surrounding them. The white shutters of a Scotch town post-office were painted black to eliminate an attractive point of interest to raiders, and the last, but not the least in importance, is the use of paint for camouflage purposes.

"Camouflage" A Child of Paris.

The confusing and baffling name, "camouflage," that has recently been adopted in our language, is by no means a newly-coined word. Camouflage is a word derived from the French language. It has been said to be a child of Paris' underworld, and there may be some truth in that, as camouflage in slang means candle, while the old French word camouflet, also meaning candle, are the roots of the word camouflage.

Perhaps dark deeds were hidden by the smoke of the old-fashioned tallow candles. The word has been in use for a long time by French actors, and means to make up. In the Belgian language (Flemish) the word kajouna, meaning with smoke, has long been in use; but whatever may be its origin, camouflage undoubtedly means to disguise, conceal, to bluff, to make something look like nothing. It means here specificially the art of fooling the enemy's eye.

The American khaki, colour of earth, dust and leaves; the German field grey; the French, horizon blue; and previously the colouring of the body of the American Indian, and even the bluish-gray peculiar to the atmospheric colouring of the South, was reproduced in the Confederate uniforms.

One of the first extensive modern applications of camouflage was made by General Smuts, in the Boer war, when all the paraphernalia was painted with colors that harmonized well with their surroundings. In Italy the mountain troops, fighting in the snow, paint themselves white in the daytime, black at night, and follow the season with daubs of yellow, blue, red and golden tints, as may be necessary to reproduce the colour effects of Nature acting as background.

Based on Animal Colouration.

The use of paint in camouflage is primarily based on the laws underlying the protective colouration of animals first mentioned by Poulton (1886) and the Thayers (1896-1902-1909), who said "that protective or disguised colouration falls into two main divisions —the one including concealing colours, mainly based on counter shading, the other including mimicry. The goal of the former principle is the rendering of animals invisible in their natural haunts. Mimicry aims at deceptive visibility.

"The need of markings is a concomitant of the principle of 'obliterative shading,' as when an unmarked solid object has been reduced to a perfectly flat monochrome by counter shading—so that it lacks all attributes of solidity—it may be quite undistinguishable, provided that its background is of a similar monochromic flat tint.

"In 'pattern perspective,' it will show that not an exact reproduction of the actual background, but a picture of that pattern as it looks when more or less altered and refined by distance, is essential to the concealing of an object, or, in other words, that the object's obliteratively shaded surface must bear a picture of such background as would be seen through it if it were transparent."

The subject of natural camouflage is interesting. In 1902 a patent was issued to two Americans, A. H. Thayer and Jerome Brush. The specification mentions that the reason any object is easily seen, no matter what colour it is painted, is because when near enough to be distinguished its various surfaces reflect, respectively, different amounts of light; the upward surfaces being the lightest, the vertical surfaces less light, the surfaces facing downward less, and the deep shadows still less. When far away, so that its various surfaces blend into one, a ship may be visible, owing to the contrast of the whole object with the surrounding sky and water. A white ship may be seen against so bright a sky as to look almost like a black one. Therefore it makes little difference what colour a ship is painted, if it be painted with only one colour, as either the whole ship will be silhouetted against the sky beyond or its different parts will present a strong contrast of light and shade. In short, the process means painting normally light surfaces dark, darkened surfaces light, and colouring the shaded portions with paint that would neutralize and blur the definition of the ship.

Angles are Effaced.

One of the theories—perhaps the best one—in the merging of the hull and upper work with the sea and sky is that the colour scheme is so applied that with distance it resolves itself into grey, and that with the aid of other splotches of paint all angles are effaced, and painting the different areas of the ship so that only one will show its true colour at a distance.

For instance, a section near the stern may be painted with large irregular spots of dark green, purple and red, while on a section next to it are painted smaller spots and lighter tones of the same colour. Still further forward another area comes to its proper distance from the eye, it will become grey and of low visibility, while the larger spots will be glaring.

Let us see how the general principles of paint camouflage were and are applied: At the battle of Somme a road was covered by the French camoufleurs with three kilometers (9,840 feet) of canvas painted to imitate grass, rocks, etc., so as to allow the troops guns, etc., to pass under, and for three days they were undetected by the enemy planes.

Forts in Deceptive Garments.

Forts and their surroundings are so painted that they may look one day like a vast expanse of green grass and the next day be transformed to well-laid tennis courts or summer cottages. A whole village street, with its old-fashioned houses and thatch roofs, were painted on canvas, and with the help of netting dipped in paint; guns, batteries and moving troops were constantly surging to a given point.

The moving pictures of the British "tanks" in action well exemplify the meaning of camouflage. The crawling land ships are covered with streaks and patches of varicoloured paint, so arranged as to appear part of the ground if viewed at a distance.

Escort wagons, caissons, tractors, moving war supply trains, locomotives and depots are so treated that almost under any atmospheric conditions, and whether in woods or open country, the deceptive art is found to be useful to a great degree.

Guns of large and small calibre are disguised to break up their well-known contours. Usually they are painted black on top and white underneath, so that they cease to look round; a few strokes of brown and green are thrown in for good meaure, and presto! —the Futurist composition blends so well with the landscape that only occasional flashes of fire remain as tell-tales.

Men on outpost duty, including wagon drivers, troops in march disguised with painted canvas or burlap, battery observation posts and observers, are sometimes painted three times a day, and to see soldiers painting piles of steel helmets grey and khaki colours is no uncommon sight. Field observers' clothes are decorated with stripes of various shades of brown and green and patches of yellow, so that they become parts of trees when up in them for observation.

Dobbin Also Camouflaged.

In 1914 the Russian Cossacks painted their white and grey horses green to make them harmonize with the foliage, in order that their movements could not be seen by scouting aeroplanes.

The French, in 1915, rendered horses as nearly invisible as possible on the field of battle by staining them a khaki colour and later a horizon blue. Can the reader imagine being awakened with a very dark taste in his mouth and seeing yellow, pink and green horses? Dummy horses and wounded soldiers used for concealing observers and the horse of Troy are known facts but not amiss here, perhaps, is the story of the Anzacs serving in France in 1916 who found near their sector at S—— a white horse which seemed to act as signal to the enemy. Where he was drawing a plough one day shells fell the next day. They went out at night and painted the horse brown.

Naturally, signs and lettering of all kinds are necessary, from the stencilling of numbers on shells to the marking of cannons, etc., with animals or other figures to replace the numerals formerly used. This bit of deceit keeps from the enemy any information regarding the number of the object or the number of the regiment to which it belongs.

Submarines come in also for their bit of decoration. In a well-remembered memoranda sent to the United States by Germany in February, 1917, it was said that "regular American passenger boats might ply their trades, if such steamers were painted in a peculiar way." In 1907 the Hague Convention approved Article 5, which provides that hospital ships "shall be distinguished by being painted white outside with a horizontal band of green about a meter and a half on breadth" so that they will not be fired upon. This practice was abandoned on the ground that it was simply pointing out targets to the German gunners!

Is a Necessary Precaution.

Before 1898 our warships were painted white and war grey during the Spanish war. Previous to the German submarine atrocities our merchantmen took to camouflaging, which became obligatory with the Treasury Department's decree (1917) that "every ship leaving this port should be camouflaged or insurance rates increased accordingly." The cost of camouflaging merchantmen is about two hundred dollars. When the giant German submarine "Deutschland" sailed from Baltimore in 1916 she was painted so as to resemble the colours of the sea as nearly as possible; the upper portion of the vessel's sides which protruded from the water, when the ship travelled on the surface, were decorated to resemble sea waves. The bluish green colour of the waves was capped with white to simulate foam.

The well-remembered sinking of the United States four-master "Lyman M. Law" by an Austrian submarine, near the coast of Sardinia (February, 1917), recalls the fact that the submarine was painted ash colour with black deck.

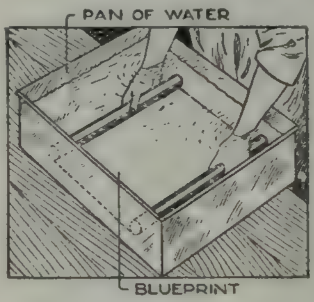
Periscopes have been painted with parallel stripes in various colours of the spectrum, so that when the colours are refracted they are converted into a white ray, making it very difficult for the enemy to see the periscope. In 1917 the German undersea craft coated some of their periscopes with aluminium so as to make them less visible.

Melts Into the Horizon.

During the first two years of the war, colour was not thought to be necessary; black and white or two shades of grey were used, although the late T. T. Jane, the well-known naval expert, had the decks, etc., of a torpedo boat painted a mottled black, white and grey, to imitate Nature's camouflage of sea birds, with their markings of black, white and grey. It was a success as seen from above, but when viewed in full light against the sky, it became a dark spot. But no matter how painted to attain low visibility—be it so well done that to the layman it looks like decorations from the Mogul Emperor's palace at Delhi, or bunches of green flowers with pink popcorn couchant, Cubist's blue and green dreams, or, again, Futurist's fancies with purple bodies and black limbs—the colour schemes used do not conceal the ships; but if the colour areas are large and the contrasts strong in value, they make it harder to accurately point a gun; but nevertheless a vessel so treated, when standing with the sun behind, appears as a large mass of very dark colour.

Washing Long Blue Prints

IN certain divisions of engineering work where long plans predominate, considerable difficulty is often encountered in washing the blue prints. They are apt to become wrinkled or torn from folding in the washing tray. A simple method of overcoming this objectionable feature is shown in the cut where, as explained in Popular Mechanics, two rollers made from an old broom handle or flag pole are cut short enough to fit into the pan crosswise. The print to be washed is wound on one roller and the free end is wound on the other roller, immersed in the pan. After the print has changed rollers the operation is repeated until the print is thoroughly washed. The rollers keep the print straight and eliminate possibilities of wrinkling, etc.



Standardization Applied To House Building

By W. Ross Young*

THERE are already examples of what standardization means in the way of expedition, economy and efficiency as applied to the manufacturing and mechanical world; and indeed it has only been through the adoption of such means that the manufacturers and captains of industry have been able to maintain their position in the world's struggle for trade ascendancy. It is known how much the duplication of thousands of articles to one particular shape, size design and specification tends to speed up production and lessen cost; and, in as far as one can apply this to housing, one is bound to obtain similar results. If the 500,000 houses which are to be built at the close of the war are each to be the subject of a special design, having each their special component parts, and again these component parts are constructed to divergent specifications, then the reverse of "standardization" will assuredly follow. The minimum results would thereby not only be obtained in the way of expedition, economy and efficiency, but the huge after-war housing programme now outlined could not be undertaken.

Beyond a general expression of opinion that standardization could with advantage be applied to component parts of buildings, there does not seem to have been any authoritative pronouncement on the matter, and, so far as is known, no definite understanding has been reached either with regard to those component parts which could be standardized, or the machinery which would be put into operation to ensure a more or less universal system of standardization being adopted with regard to them. Many of the munition factories designed for destruction will have to be converted into equally busy factories for construction. It will be necessary suddenly to change over and consequently decide exactly how this is to be done. The manufacture of building material will take a large place in the immediate after-war industries, if the nature, sizes, and amounts to be manufactured can be decided in time.

In considering the question of standardization, it is evident that there must be some definite relationship between "type plans" and "component parts." Indeed, it is difficult to see how a system of "standardized component parts" could be fitted into plans, unless the plans themselves complied, at least, with certain recognized "standard dimensions." Further, the standardization of component parts must involve some system of "standard specifications," to control the construction and manufacture of these.

It would appear, therefore, that the question of standardization in relation to housing can best be divided and discussed under three interdependent phases—namely, "type plans," "component parts," and "standard specifications."

Standardization of Type Plans.

To the architect the word "standardization" when applied to housing, and especially to type plans, may seem at first altogether too mechanical, and therefore antagonistic to applied art. At the outset he is naturally inclined to conclude that it could only lead to monotonous results, and consequently prove a grave blunder were he to concede its introduction in any shape or form. While, therefore, the author does not propose unduly to press his views on this phase of the subject—for he recognizes that it is one which requires extremely careful consideration before its adoption—he nevertheless feels that it may prove of interest to those large numbers of architects, engineers and municipal authorities who are considering housing schemes if he could place before them such facts concerning this question of standardization of type plans as have specially appealed to him in carrying out recent housing schemes of considerable magnitude.

So long as housing remained a matter of private enterprise, and where it was carried out in a sporadic and piecemeal fashion, standardization was wholly out of the question. Now, however, that housing is to be more or less controlled by the State and there are to be provided hundreds of thousands of houses of practically the same size and accommodation, built and finished with more or less the same kinds of materials, and indeed to all intents and purposes duplicates of each other, a great chance presents itself for the consideration of some system whereby standardization can, to some degree at least, be adopted, especially so if this can be done without in any way impinging upon the recognized necessity for preventing monotony and the giving to schemes that feeling of tradition and meaning common to the district in which they are erected. One must recognize the social influence and aspirations which artistic housing can create in a community, and cannot afford to sacrifice this even on the grounds of economy and expedition. A fuller examination may, however, show that standardization properly applied might be the means of producing the very opposite result.

When considering standardization as applied to type plans, one can first see how far this can be applied to individual housing schemes, and thereafter estimate to what degree it could be extended in a more or less universal manner; for, if the full benefits of standardization are to be obtained, nothing short of some universal application of recognized principles would fully meet the case.

With regard to individual housing schemes—which for the most part will be carried out in groups of from four to eight houses—standardization, as the author views it, would consist in designing a series of type plans in such a way that each type could form a unit or units in the composition of groups—that is to say, the plan and elevation of each unit or type in the same series would be designed in harmony with the other types forming the same series; and so if more than one type was employed in the composition of a group the group so formed would have as complete and harmonious design as if it had been the result of one individual and preconceived design. Thus by a system of permutation there could be evolved even from a very limited number of type plans an almost infinite variety of groups, each group, however, being different in shape, design and external appearance from any other group, but nevertheless forming a complete design in itself.

By way of illustrating the practicability of this system of permutation the writer has had designed four type plans illustrating some of the numerous combinations and diversity of external appearance and effect which would result. The plans only show a few of the many shapes which the groups might readily take; for indeed it is difficult, if not impossible, even to calculate the number of different varieties of groups which could be evolved, even if the type plans were limited to four designs.

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*The Surveyor

The author has found in working out a scheme of 500 houses on the basis of four-type plans that there would be no trouble in so arranging the disposition of the type plans forming the groups as would ensure that no two groups would be the same; and, further, that it would be possible to constitute the groups in such a manner as they would readily fit into any desired position in relation to the lay-out in the way of quadrangles, street corners and other groupings. While the example given has been limited to four type plans, it is obvious that if a greater number of type plans were used the variation would have an almost infinite range of variety.

In working out the system there would naturally be a series of type plans prepared suitable for south-fronting houses, and another for north-fronting houses.

To fully appreciate this system of permutation and to realize more fully that it would have exactly the opposite effect from that tending to produce monotony, one has only to visit some of our more recent housing schemes. There it will be found the numbers of types have, of necessity, been limited and vary in most cases from three to six. In such schemes it will be observed that in almost all cases the groups consist of one type of houses only, and that the different types do not permit of a system of permutation. This has resulted in repeating groups of the same type over and over again, as the number of different groups is strictly limited to the number of type plans adopted.

It may be asserted that in a housing scheme the number of type plans could be indefinitely increased so as to prevent that monotony just referred to in preference to the adoption of any system of permutation. This, however, is exactly what local authorities and others will not be able to do if the after-war housing programme is to be carried out, having economy and speed as two paramount factors. It is common knowledge that the cost of a housing scheme and the speed at which it can be carried through is largely contingent on the limitation of the number of different type plans introduced, and that in some recent housing schemes of very considerable magnitude the type plans suggested have had to be greatly decreased in number from that intended, so that it has only been by a patched-up system of permutation that passable results have been obtained.

Standardization of Component Parts.

That there is great need for the evolution of some system whereby standardization could be applied to component parts can perhaps best be appreciated by an examination of the many type plans for housing schemes which have been prepared in recent years, and how little attention has been paid in the design to this matter. If observations are directed, for example, to windows—and the same applies throughout the designs—it will be seen that no two windows in some types have been drawn to the same size, while the windows in the different types in many cases only differ in the size by fractions of an inch. Such gross neglect to recognize the first rules of standardization has undoubtedly led to increased cost in building and the lessening of production. It is not too much to say that in practically all our housing schemes there would be quite a sufficient selection of windows to draw upon if there were, say, twelve to eighteen standard sizes definitely recognized.

In the absence of standardization of component parts, manufacturing firms cannot possibly proceed with the manufacture on a large scale. By so doing they might manufacture component parts to sizes, shapes or specifications which an architect might not ask for in the next twenty years; and until some recognized system of standardization is adopted it will not be possible to set going the large manufacturing firms on a post-war basis. On the other hand, if standard designs for component parts were agreed upon and the information circulated among manufacturers, it would mean that at the end of the war they would be able to absorb enormous numbers of workmen and proceed with the manufacture of component parts by the thousand.

Standardization of component parts to be effective and universal, would have to be so conceived that, as far as possible, the standard parts of one type of house would be inter-changeable with those of other types.

The question naturally arises as to which of the component parts in cottage buildings could most readily be standardized, and the following seem to be some of those materials which could be most conveniently manufactured to a definite size and specification:

(a) Concrete window sills and lintels, kitchen jambs and lintels, concrete slabs for partitions, shuttering for concrete floors and roofs, reinforced concrete including floor joists, ceiling joists and roof rafters.

(b) Doors, windows, picture rails, skirting boards, facings, stairs, shelving, hinges, locks and general ironmongery.

(c) Ridge tiles, chimney pots, roofing tiles and special pieces in connection therewith.

(d) Rhones and conductors, together with angle pieces and off-sets connected therewith, hot-water cylinders, feed water tanks, baths, sinks, water-closets, flush cisterns, scullery coppers, water taps, electric fittings, etc.

(e) Fireclay goods, including sinks, drain pipes, inspection eyes, bends, traps offsets, etc.

(f) Grates, ranges, stoves and general cast-iron work.

Assuming that the component parts of house designs were standardized, it would only effect economy in the manufacture and construction of the houses, but save infinite technical labor on the part of the architect and contractor. For example, instead of the architect having to draw out carefully prepared details of the various component parts, he would simply have to quote the numbers referable to these. In return he would expect in each case a precise article of a precise make, design and size, free from all imperfections, and exactly in accordance with the standard drawing and specification implied by his reference to the number. The contractor, on the other hand, when asked to tender for a scheme, would similarly only require to get in touch with the manufacturing firms and ask them to quote for a definite number of standardized articles, knowing also that whatever quotation he received was for a definite article made to a definite size and specification, and that it would comply in every respect with the architect's requirements.

The scheme for standardizing component parts is a business-like proposition, and could, the author feels sure, be worked out and put into operation in quite a short time, if only it were taken up in authoritative quarters.

Standard Specifications.

If standardization be applied to component parts of buildings then it follows that these will have to be constructed to some definite specification. The preparation and adoption of "standard specifications" regulating the quality, composition and manufacture of building materials would result in one of the greatest advances yet made in the building world, and would have a widespread and beneficial effect in securing expedition and economy of construction. It would further secure a much better and more uniform standard of building construction. In this regard one could have no better example of the benefits of a standard specification than the good results which have accrued through the preparation and recognition of such in connection with the manufacture of Portland cement. These results are sufficient in themselves to justify the adoption of the principle as applied to other forms of building material and could be readily applied not only to the manufacture and composition of materials, but to the construction work itself. At present architects have to write long and elaborate specifications controlling these, and even then it is difficult, if not impossible, to obtain materials or construction in accordance with such specifications. Hitherto specifications have been most unsatisfactory, lacking that definiteness necessary to prevent inferior materials being manufactured or used.

In viewing the whole question of standardization in relation to type plans, component parts and standard specifications, it is necessary to consider the fact that there is a housing problem confronting the country which, so far as can be seen, is not capable of solution unless along lines somewhat different than heretofore recognized and practised.

After the war houses and still more houses will be required, and the whole case is one as to whether this great housing programme is to have some system of uniform control applied to it or if there are to be thousands of architects, engineers, builders and manufacturers directing it along different lines without any attempt towards co-operation or unity of effort. Any such system has broken down and failed most miserably in all the great industrial undertakings, and it would be too much to hope for success if applied to the building world. The least therefore those who are vitally interested in this great housing programme can do is to investigate fully what method can best be adopted—whether it be by a system of universal standardization or standardization as applied to individual housing schemes—to secure those three important factors the author has already referred to—namely, expedition, economy and efficiency, and all that these great factors imply.

The Building of a Concrete Barge

RECENT indications point toward concrete construction. Perhaps the ordinary barge is the simplest type of shipbuilding to which concrete as a material well adapted to ship concrete is now being successfully applied. The general form of the barge and the absence of intricate structural details when compared with other craft, no dubt tend to greatly increase the facility with which this new material may be applied both as regards cost and speed of construction. Since the subject of concrete barge construction is one of growing importance, the following paper read before the American Concrete Institute by L. L. Livingston may be of interest in that it enunciates a method of construction employed recently in building a concrete deck barge at New York:—

The boat is a deck barge 112 ft. long, 33 ft. wide, 10 ft. deep. It has 18 in. shear and 2 in. camber in the deck. The boat is divided into six compartments by one longitudinal and two transverse bulkheads. The bottom and deck beams are carried by longitudinal reinforced concrete trusses. The panel length of these trusses is 7 ft. center to center, and the depth equal to the depth of the boat. They are spaced 5 ft. 4 in. apart across the width of the boat and are reinforced to take care of any hogging or sagging strains due to the following conditions:

1—The central third of the boat loaded with the end thirds light.

2—The end thirds loaded and the center third light.

3—One-third the load on one end of the boat.

4—The ends of the boat supported on the crest of a wave equal in height to 1/20 its length.

5—The centre of the boat supported on the crest of a wave equal in height to 1-20 its length.

6—The boat light supported in the extreme ends with no buoyancy.

The bottom, side and deck slabs are 2¾ in. thick, supported by beams 3 ft. 6 in. o. c. The stresses used in the design were:

Completed Concrete Barge

Reinforcing steel, 16,000 lbs. per sq. in., extreme fibre stress in concrete, 800 lbs. per sq. in.; allowable shearing stress in beams reinforced with bent up rods and stirrups, 125 lbs. per sq. in.; allowable bond stress, 100 lbs. per sq. in.

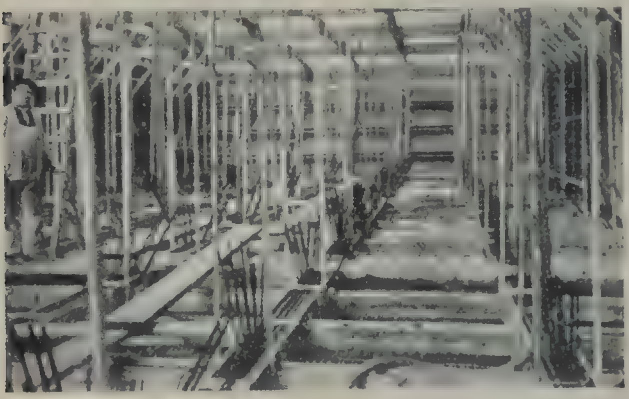
The boat was built for side launching. The building ways were spaced 14 ft. o. c. The forms were built in panels and bolted together. The bottom panels, which were carried by the building ways, were supported at the ends by wedges, which permitted them to be removed before removing the building ways. The cabin, deck bulkheads and fenders are of wood.

As a cement gun was used to concrete the sides and bottom only an outside form was necessary. The materials were mixed dry in a batch mixer and conveyed to the guns, so located as to cover the entire boat.

All materials were tested and favorably reported for use for concrete in sea water.

The proportions used in the mix varied. In the bottom it was one part by volume of cement, 1½ parts of sand and two parts of limestone screenings. In the sides the mix was one part by volume of cement to 1½ parts of sand. In the interior beams, trusses and deck it was one part by volume of cement, 2 parts by volume of sand and two parts by volume of limestone screenings. The limestone screenings were screened through a ¼ in. screen and were well graded in size. Giant portland cement was used.

The reinforcement used in all slabs and bulkheads was Clinton electric welded galvanized wire mesh, No. 3 and 8 wire, spaced 2 in. x 16 in. Havemeyer bars were used in the beams. This reinforcement, together with the forms for the bottom beams and the ribs in the side were supported from the top by beams spanning the width of the boat.



Interior Construction

The concrete was applied in the outer hull in three operations. First, the bottom slab and beams were concreted; second, the side slab and beams for approximately one-half the height of the sides, and the third operation completing the sides.

It was necessary to concrete the sides in two operations, as it was found that in attempting to concrete a 2¾ in. vertical slab with the cement gun for a greater height than about 5 ft. there was a decided tendency for the concrete to drag or pull down, causing it to crack before it had set.

The bitts were made of 10 in. pipe, with holes through the bottom and sides for reinforcing rods, which spread out on the deck.

Three sets of 6 in. x 8 in. fenders were attached to the sides of the boat by bolting through the side ribs. Holes were provided in the concrete for the bolts by wooden pegs placed in the forms before concreting. After the forms were removed the pegs were bored out of the concrete.

Marine glue was heated and poured into the bolt holes and the bolt for attaching the fenders was inserted while the glue was hot, the glue filling any space between the bolt and the concrete.

It was intended to launch this boat in the fall of 1917, but upon removing the outside and bottom forms, it was found that the surface was not sufficiently uniform to insure a water tight hull. It was necessary to go over the boat very thoroughly and to remove the sand pockets or defective concrete and replace them with new concrete.

While the writer believes that it is possible to build a water-tight hull with the cement gun, with less sand pockets than were encountered in the construction of this boat, he does not believe that even under the most favorable conditions as to the designs of the boat and in the operation of the gun, that sand pockets can be entirely eliminated. After all the defective concrete was replaced, the hull was painted with a neat cement grout, which was thoroughly rubbed into the pores of the concrete.

Four launch-ways were used in launching, spaced so to divide the load as equally as possible. The declivity of the ways was ¾ in. per foot, and the pressure was approximately 2½ tons per sq. ft. of way. The launching was very successful. The boat draws 3 ft. 8 in. of water when light and shows no leakage.

After having made a thorough study of the design and the methods of construction of concrete barges, the writer believes that there are no difficulties that cannot be overcome, and that eventually reinforced concrete will prove to be a most desirable material for the construction of barges and other floating craft, both from the viewpoint of first cost, and for serviceability.

Mainly Constructional

East and West—From Coast to Coast

The Beaver Engineering Company, Limited, Montreal, have been incorporated; capital stock $100,000.

The city council of Sault Ste. Marie, Ont., will ask the Ontario Government for $200,000 in order to help out the housing problem in that city.

The Domestic Engineering and Specialty Company, Limited, have been granted letters patent. The capital stock is $20,000, and the chief place of business, Montreal.

The Imperial Bank, Toronto, have purchased the site at the corner of King and Francis Streets, and will proceed immediately with the erection of a $30,000 bank building.

The demands of building carpenters in Vancouver for an increase of from $5.50 to $6.50 a day have been definitely refused by the contractors, who offer $6 for an eight-hour day.

A new brick platform is to replace the plank platform at the Grand Trunk Station, Niagara Falls, Ont. The company have found the wooden platform unsatisfactory owing to quick decay.

Building permits in Toronto for the month of July totalled $1,094,278, as against $762,004 for July, 1917. The total for the first seven months of the year is $4,835,293, as compared with $4,087,782 in 1917.

Personals

Mr. G. Murgatroyd has been appointed assistant engineer, Montreal Division, Grand Trunk Railway.

Mr. E. V. Buchanan, general manager of the London Public Utilities Commission, was recently in Winnipeg, and while there inspected work on the aqueduct

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The Epic in Engineering

ENGINEERING is a profession in which there is great opportunity for heroism. The engineer is playing a most prominent part in the present struggle and the story of the war will hold no brighter page than his self-sacrificing devotion and tireless energy under the most trying and tragic circumstances. But it is not only in time of war that the engineer has displayed self-sacrifice and courage in the service of his country and of the race. Through the centuries he has quietly and unassumingly been doing a great work, making the world fit for men to live in, as they have increased in numbers and advanced in industry and knowledge. Historians laud the triumphs of statesmen and soldiers and the works of poets and philosophers, but of the achievements of the engineer little is said. Nevertheless he has brought all the corners of the world together, he has encircled it with the steamship and the railroad, he has made it possible to flash messages across continents, he has released the riches buried in the earth for the benefit of mankind, has delved beneath her crust for metals and fuels—an undreamt of mineral wealth—he has produced heat, light and power from her rivers, and has distributed the waters to fertilize huge areas of desert land, he has established cities and towns and linked them with roads and bridges, he has built up industry and co-ordinated it, he has curbed disease through the development of sewage and water purification systems and the erection of sanitary dwellings, he is indeed at once the pioneer of industrial and economic progress and the conservator of the material welfare of the human race. Yet his achievements are accompanied by no flare of trumpets; they are taken for granted; people accept his works without looking for a signature. Why is this? Probably because the engineer's triumphs are over mud and matter. The ordinary individual sees no romance in a sewer or a roadway, or even a bridge. He makes such unceasing use of the luxuries the engineer places at his disposal that they become common-place necessities and he forgets their source. He is so completely surrounded by miracles of engineering that he has come to regard them as mere trifles.

True there are men who have been big enough to recognize the indebtedness of the human race to the engineer. Victor Hugo's admiration was aroused at the intrepidity of the man who undertook the repair and recording of the Paris sewer system in the beginning of the nineteenth century. The system had been built in a haphazard manner and was like a vast catacomb. It was becoming blocked up and falling into disrepair and the sewage had on more than one occasion backed up and flooded out the dwellings. Hidden dangers lurked in it—poisonous gases, sudden gulfs, mirey quicksands. The general public regarded it with a sort of terror and the city authorities did not dare to explore its uncharted windings. There was one man, however,—an engineer—who was not afraid to face this unknown, subterranean problem. He undertook the repair and charting of the sewer, and though many of his men refused to work before the project had progressed very far, while others were overcome by the sewer gases, and numerous unprecedented difficulties were met with, he finally carried it through. It is not too much to say that an undertaking such as this requires as much courage and determination as the venture of Columbus across the Atlantic Ocean.

These engineering achievements attract but little attention, however. They are not spectacular and do not appeal to the crowd. It will be a source of encouragement, nevertheless, to the engineer who is plodding away in the heat of the day and sees but little recognition, and little return for his services, to remember that there is more than mud and mortar in his work, while he is handling matter he is furthering ideals, he is contributing to progress, that the profession to which he belongs is a noble one and its members have been and are the benefactors of the human race.

The Labor Unrest Contagion

THE employees of the waterworks department in St. Thomas, Ont., have demanded increases in wages from 30 to 35 cents and from 32½ to 38 cents per hour. The board, after considerable discussion, decided to meet the men half way, granting them 32½ cents and 35 cents. However, as we go to press, it is reported that the men will probably refuse this offer. During the two weeks previous, all the other city employees, with the exception of those of the gas works and hydro-electric department, have also demanded increased pay. These developments are only to be expected as a logical sequence of the labor troubles in Toronto, Winnipeg and elsewhere. Human nature and the labor organizations make it impossible that it should be otherwise. When the workingman sees his fellow-laborers in other towns and cities gaining wage increases by the simple expedient of strikes and threats, he is quite naturally inclined to follow the same course. He needs more money—nearly everybody does—and can get it easily. Why then should he do without it? As long as strikes win the demands of the men they will continue to strike—reason or no reason.

The All-Welded Ship

THE first all-welded vessel, which was recently launched, somewhere on the South Coast of England, was built in a shipyard operated by the Inland Waterways and Docks section of the Royal Engineers. The Engineer gives some details regarding the method of construction. In this vessel the "shell" up to and including the bottom seam of the bilge plate, is continuously welded inside and out. The cross seams are similarly "tack" welded. The frames, floors, deck brackets and non-water-tight bulkheads are all "tack" welded. In the case of the deck plates "butt" welding (i.e., the plates arranged end to end, without any overlap) has been adpoted. In the construction outlined, it is considered that a good margin of safety has been allowed. It is thought that the general adoption of electric welding would speed up production, more particularly in the assembly of bulkheads, deck structures, fittings, and other interior work. It is computed from the results obtained on this experimental vessel and other Admiralty work that a saving of 20 per cent., or possibly 25 per cent., could be effected in both time and material. The United States Shipping Board has been in close touch with this experimental work, with the result that arrangements are in hand for the manufacture of a number of 10,000 tons standard ships, in the production of which "riveters" will become "welders." Whilst the first vessel just launched is rivetless, it is calculated that these large vessels will only have about 2½ per cent. of the originally intended number of rivets.

Utilization of Coal Slack as Fuel

Coal slack or coal dust is to be found in nearly every household. It is generally used to bank a fire, burns dull, much of it drops through the grate, and is so unsatisfactory that one often pays to have it removed. No more waste of coal slack. Buy a small quantity of Portland cement, then add 1 part by measure (not by weight) to 20 parts of coal slack, mix very thoroughly in the dry state, then add gently and by degrees a small quantity of water and mix well.

Care must be taken not to make the combination too wet—it should just hold together when squeezed in the hand.

It is now ready to be placed in a mould. An excellent one is an ordinary small flower-pot, 4 or 5 in. in diameter. Press the mixture into this firmly, and it can be at once turned out by inverting the pot. Keep in a dry, cool place for 5 or 6 days, and it is ready to burn, which it will do like an ordinary lump of coal.

Alternately the mixture can be moulded in the hands like a snowball, and in a week becomes quite firm.

As a guide to correct proportions, a bucket measure (say, 3 gal.) of coal dust will require 1 1, 5 pints of cement (i.e., the 5-in. flower-pot about three parts filled) and about 2 1-2 pints of water.

The Shell of the Long-Range Gun Which is Bombarding Paris

Nothing definite has yet been discovered as to the nature of the German long-range gun nor of the shell it fires. M. Nicholas Flamel, in a further article in a recent number of Le Genie Civil, puts forward some plausible hypotheses, based on the known facts, viz.: the fragments of burst shell; the white smoke which nearly always accompanies burst; the fact that the splinters show no traces of adhering explosive; and the use of the diaphragm with its special fittings, the exact function of which is still inexplicable.

After considering the various recognised explosives and rejecting them for one reason or another, M. Flamel suggests that the Germans may have used the following method, in which case the diaphragm would fulfil a different function from that which he previously attributed to it. In order that the shell should leave a white smoke on bursting, which is desirable for registering purposes, but no trace of explosive on the metal of the shell, he believes it possible the Germans may use an explosive of the panclastite or hellhoffite type which would burst on impact without a fuse being necessary. The diaphragm and auxiliary parts, the function of which is still obscure, would be used to divide the shell chamber into two parts, which would be in communication with each other only on the gun being fired. The impact on discharge would open a communicating channel and allow the more dense liquid to flow into the rear chamber while the shell was travelling along the ascending part of the trajectory. Rotation of the shell would give the mixture time to be thoroughly incorporated by the time the shell had arrived at the end of its flight, since the time of flight is three minutes. An explosive of this kind would be safe on the gun being fired, since the explosive mixture is not formed until the shell has left the gun. It would also be certain to act when the object was struck, because it has been shown with certain panclastites of the carbon disulphide type that it is impossible to fire them from a gun, even at low muzzle velocities, without their detonating.—The Engineer.

Gouge Soft Spots Out of Concrete Pavements

In laying concrete pavements, after the top has been surfaced and left to harden but before the covering of earth is thrown on, a careful inspection of the surface should be made. By the time the concrete has set long enough to sustain a man's weight without showing, small bright and shining spots will be seen on the surface. They may be few and far between or there may be a great number of them. If the inspector will insert his pocket knife into these bright places he will find them soft in comparison with the rest of the surface. It will be found that these soft spots are earth or some kind of clay or loam, or a lump of sand, wood, coal or soft stone. All this soft material should be dug out, the holes cleaned and then filled with fine and rich concrete, filling the holes a little more than full. In spite of all the care possible in providing clean and pure material, it is impossible not to have some foreign matter get into the concrete, and the adoption of the foregoing kink will prevent many a hole in the surface of a concrete pavement.

New Administration and Sales Building for the London Hydro System

THE London Hydro-electric Commission have just moved into a fine new administration building, some features of which are illustrated herewith. The building was originally designed for structural steel, but with a view to cheapness and a greater degree of fireproofing, the structural design was changed to reinforced concrete. The design is by Mouchel & Partners, and is the Hennebique System of flat slab construction, T-beams being used in conjunction with the floor slabs. The dimensions of the beams and columns throughout give a light and pleasing appearance and compare most favorably, in overall dimensions, with any other type of construction. The exterior walls are of Indiana limestone, backed up with common white brick. The interior partitions, with the exception of the vault walls, are gypsum block. The vault walls throughout the building are common white brick backed up on the inside with hollow tile to secure air space. The rough stairs throughout the building are also built of reinforced concrete, the finishing treads and risers, both terrazzo and marble, being put in place after the erection, and securely bonded to them. In designing the structure of the building, due provision was made to add another storey should this be required. For that reason the fourth floor slab was laid and the roof built on top of this so that if at any time the Commission decide to erect another storey, work can be gone on with without disturbing any of the occupants of the building.

As will be more fully described hereafter, the second and third floors are terrazzo and were laid on the rough concrete slab, the rough floor slab being left one and a half inches below the finished floor line for this purpose. The same scheme was also followed out on the ground floor in the case of the marble mosaic and marble ashlar floors.

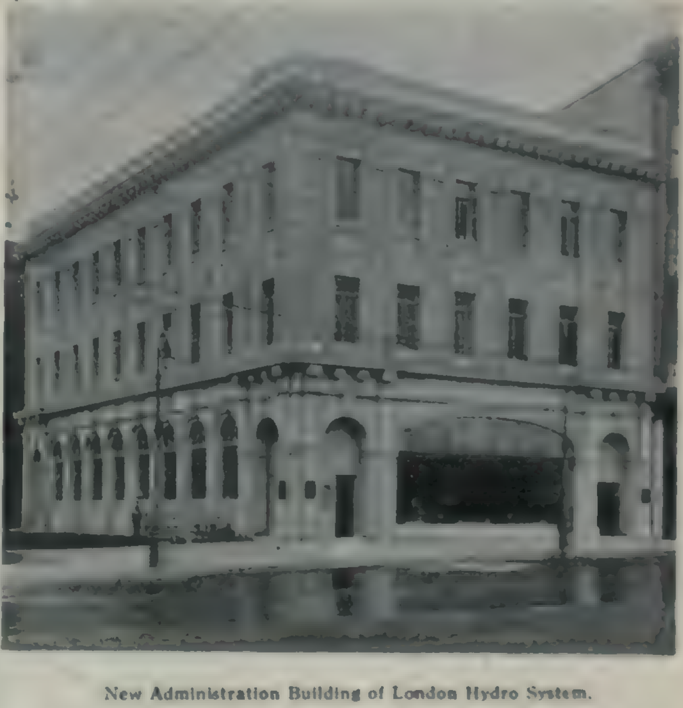
By referring to the photograph of the exterior of the building, Fig. 1, it will be seen that the design is semi-classical. The building is faced in Indiana limestone. Here also provision was made for the addition of an extra storey, the top portion of the coping and cornice being so arranged as to be removable in case of the addition of an extra storey.

Floors

The building being constructed with the intention of making it fireproof, floors are also of fireproof construction. The basement floor is the workshop and storage at rear part of the basement is constructed of concrete. The basement display room and the second and third floors are floored with terrazzo, with the exception of the dining room, board room and general manager's office on the second floor. The dining room is floored in quartered oak in keeping with the surrounding trim. In the general manager's office and board room linotile has been used over the rough concrete floor. In the main office and Hydro Shop marble mosaic has been used in combination with a Grecian border design. The public lobby leading to the upper floors is floored in pink Tennessee marble, laid in ashlar form. In the general accounting office cork linoleum was laid on the concrete floor. It will be seen, therefore, that an effort has been made to use fireproof floors in keeping with the rest of the building.

Interior Trim

The trim throughout the building with the exception of the ground floor, general manager's office, board room and dining room is steel. Hollow steel doors, base, chair rail and picture moulding has been used. The steel trim throughout the building with the exception of the board room, general manager's office and dining room, is finished in Circassian walnut. On the ground floor the trim in the public space is marble. The dado is composed of Laurentian base, rails and stiles with Italian pavanazzo panels. The apron and cap for the dado is Vermont marble, McMullen gray. The door and sidelight trim is also McMullen gray. The counter for the water and light office is constructed of the same marble as the surrounding dado. The top, however, is partly wood, to enable the clerks to use the counter for their ordinary duties. The dealing plates are marble, in conjunction with which are used marble consols of a very neat design. In the front show window a marble mantel has been placed in keeping with the rest of the marble work. The stair to the basement display room from the public space ground floor is faced in Napoleon gray, with Napoleon gray treads and risers and an ornamental iron balustrade. The public lobby, as stated before, is floored in pink Tennessee marble. On the walls of the public lobby, to the height of the top of the doors, Napoleon gray marble has been used. The terrazzo treads and risers were built in forms on the job and polished before being placed in position, thus securing the best possible job. In the general manager's office and board room



New Administration Building of London Hydro System.

the general idea of fireproofing has been eliminated, the trim, including wall paneling and ceiling panels, are of British Honduras mahogany. The doors of these rooms, which are steel, have been grained to resemble this trim as nearly as possible. The dining room, which is the only room in which wood trim has been used, is panelled in oak, a buffet being built in the end wall.

Windows

The building has been provided with the latest class of steel casement windows. These are fitted with bronze hardware of a design in keeping with the rest of the interior hardware throughout the building, which is also bronze. The main show window, on the ground floor, as will be seen from reference to the photos, on account of its large size has extremely good advertising value. The transom part of the show window, also the transom heads for the large casements on the ground floor, are glazed with prism, the remainder of the exterior glass being plain plate. On the rear court wall a cheaper type of window has been used, in the form of a double hung steel sash.

Interior main busines office—London Hydro

Plastering

The ornamental plastering throughout the building was erected from designs submitted by the Commission's draughtsmen. The ground floor was the only floor in which any attempt was made in the line of ornamentation. The walls and columns on the ground floor from the dado up to the ceiling beams are stucco, the remainder being ordinary white plaster. The concrete ceiling beams were firred and a neat design of a beam used. The octagonal centre columns were fitted with a neat cap. The only other room in which there is any ornamental plastering, with the exception of the ground floor, is the demonstrating dining room, on the second floor, where a plaster cornice is used in conjunction with a ceiling panel mould. The plastering work throughout the building is the best quality three-coat work, with the exception of the ceilings, which, on account of the concrete being very close grained, it was deemed advisable to use gauged plaster, and only one coat.

Ventilation

The toilet rooms and basement display room have been equipped with a mechanical ventilating system of an exhaust type. The demonstrating kitchen is also equipped with a separate ventilating system, composed of a porthole fan mounted in the exterior wall.

Lighting

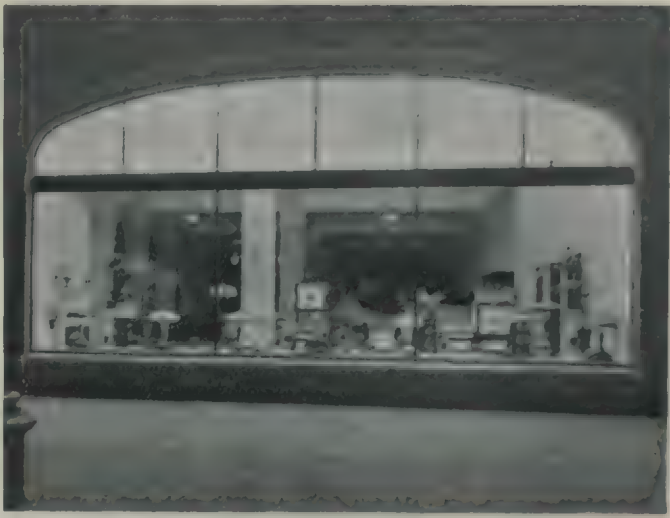
The lighting fixtures throughout the building are of the latest design, and were designed to secure a maximum amount of efficiency. The fixtures, with the exception of those in the board room, general manager's office and toilet rooms, are bronze. The fixtures in the general manager's office and board room are finished in oxidized silver, and in the toilet rooms nickle plated finish has been used, in keeping with the rest of the equipment. The lighting for the main show window is a decided innovation, lamps being concealed behind prism glass in the soffit of the arch around the window. In order to secure ventilation for the large number of lamps thus enclosed, vent outlets have been provided in the soffit of the ceiling beam immediately above. This type of lighting has proven very satisfactory and much favorable comment has been made upon its neat appearance and general efficiency. In the basement display room, which by the way, is entirely artificially lighted, another new system of lighting has been used, in the form of lamps placed behind a false wall directed against a wall painted a sky blue, immediately behind the false wall, and placed so as to reflect the light back through the windows in the false wall, thus making an indirect lighting through ground glass which is practically the nearest approach to daylight possible. This also has received much favorable comment. By referring to the photos of the basement display room, you will see that the distribution of light is perfect, there being practically no shadows. On the ground floor bracket lights have been mounted on the columns and pilasters, adding very much to the artistic beauty of the room.

Heating System

A forced system of hot water heating has been used throughout the building. However, provision has been made to operate the system by gravity in case of a breakdown. The radiators in the public space on the ground floor have been placed behind the marble dado by the use of bronze grills, the space occupied by the radiators being entirely enclosed from the back, thus forcing the heat out through the grills. A small grill has been used at the bottom to give a forced circulation to the air surrounding the radiator. Provision has also been made in the piping to install electric heating

A section of the basement—Lighted through a false wall.

Front show window—Interior lights on, window off.



Front show window—Interior lights off, window on.

units at some future date, when the supply of Hydro power warrants the change.

Plumbing

The plumbing system throughout the building was designed and installed by the Commission's own staff. The very latest type of plumbing fixtures have been used throughout. On the hot water system in connection with the plumbing system an electric heater has been used, thus making the hot water system entirely independent of the heating system. All lavatories have been fitted with the latest type of water closets, flushometer valves being used in place of the storage tanks. Here also provision has been made for the addition of an extra storey.

Glass and Glazing

The exterior glass, with the exception of transoms over the ground floor windows, is plain plate, and the transoms prism glass. The glass in the interior partitions throughout the building is chipped wire, in accordance with the general scheme of fireproofing.

Electric and Telephone Wiring

The electric conduit system and the telephone piping were designed and installed by the Commission's own staff of wiremen, the piping being laid in the floors and walls and outlets provided in same during the construction of the building. The piping system is a most complete one, every office room in the building being provided with telephone and base outlets on all four sides. All of the electric wiring was carried out by the Commission's own staff, as well as the placing of the conduit piping. The Bell Telephone system was installed, with the exception of the conduit piping heretofore mentioned, by the telephone company's wiremen, each outlet being wired but only one outlet in each office being used, the advantage of having the extra outlets wired being their easy access in the case of re-arrangement of the furniture being made. In this connection it might also be mentioned that the electric time system throughout the building was also installed by the Commission's own wiremen. The Commission's wiremen also installed a bell system throughout the general offices. In connection with the Bell Telephone system, it might be mentioned that the ground floor is equipped with an information office which also holds the telephone switchboard connected to some fifty telephones throughout the Commission's new building, the City Hall and all of the city sub-stations, an operator being placed in charge of the board.

The other photographs show that the commercial end of the enterprise is exceptionally well taken care of, for it is doubtful if more beautiful and attractive demonstration and sales rooms are to be found anywhere in Canada. One of the views shows the interior of the main room; another shows a section of the basement. In this latter the lighting arrangements are particularly good; the majority of the light is obtained from artificial windows in the wall shown at the right hand of the photograph; this is a false wall and behind it are mounted numerous lamps, the light of which is directed outward against the real wall and reflected back into the basement through ground glass window glass; the reflecting wall is painted sky blue, so that the final effect is that of an almost perfect daylight. The photograph shows that the distribution is as good as could be desired, there being practically no shadows.

The other two photographs are exterior views of the show windows. In one of the photos the window lights are off and the interior lights on, and in the other window lights are on and the interior lights off. This latter picture demonstrates the very good effect obtained by means of window lamps concealed in the archway above the window with prism glass mounted along the under side of the arch.

The building was planned by the Commission's own labor. Contracts were let for several of the different staff and all work as far as possible carried out by day works, but were inspected by the Commission's staff from time to time. The estimated cost of the building is $115,000.

Women have been employed, for some time past to **spray tar upon the highways of Westminster, England**, according to a report in the London Surveyor. J. W. Dugdale Bradley, city engineer, reports that, generally speaking, their work has been quite satisfactory. They work 50 hours per week, and the rate of wages in Canadian money is 20c. per hour, rising to 30c. per hour on satisfactory service. **Women who manipulate brushes for spraying tar receive an** additional 4c per hour. They wear uniforms, consisting of clogs, caps and gloves, which are supplied by the city. Portable mess rooms and lavatories are also provided for the women workers.

Pointe Claire also Conserving Citizens' Health with Modern Filtration Plant

THE Quebec Board of Health has lately been very active in demanding that towns provide good and safe supplies of water, and under this stimulus several towns have installed mechanical filtration plants. A plant of this description has just been completed at Pointe Claire, from plans by R. S. and W. S. Lea, consulting engineers, Montreal. The general, contractors for the work are Messrs. Arsenault & Plamondon, Ltd., Montreal, the mechancial equipment of the plant being supplied by the Roberts Filter Manufacturing Company, Inc., Darby, Pa.

The water is taken from the St. Lawrence, through an intake pipe in Lake St. Louis, and prior to the construction of the filtration plant was pumped to a tower, and after being chlorinated, distributed to the consumer. The old intake pipe is still used, together with the pumping equipment, a low lift pump having been added, so that there is now housed in the pumping house—which is a separate building—the old high lift pump and the new low lift pump. The Wallace & Tiernan chlorination apparatus is also in the same building.

The plant consists of coagulation basins, two filters, clear water well, and an old pumping house, the capacity being a million Imperial gallons per day. The filter building is 52 ft. x 26, and is constructed of brick on concrete foundations. The floors are of reinforced concrete, with a surface finish of 1:2 cement mortar an inch thick. The roof is of frame construction, covered with asbestos shingles. The building is of two stories; the filters are over the clear water basin, with the operating floor and pipe gallery above the fiulters. On the second floor are located the chemical tanks. The building is electrically lighted.

The coagulation basin is 50 x 30, of reinforced concrete, covered with a concrete and earth roof. There are two retaining walls to support the embankment; one at the west end of the filter building has a single course brick face and concrete coping, the other at the north end of the plant is of reinforced concrete. The floors of the basins have a smooth 1 : 2 mortar cement finish, while a coat of creosote followed by a coat of hot Barrett specification waterproofing pitch.

Provision is made for future extensions of the plant on the west side, the plant being so designed that an addition can be easily made to the structure of the building and to the plant.

After being pumped into the coagulation basins, the water is treated with sulphate of aluminum and by gravity flows into the filter beds, each 12 ft. 6 in. wide by 15 ft. long. Each filter is equipped with a strainer and air system for collecting and washing the water. The strainers are made up of headers and laterals (spaced on 6 in. centres), the strainers being of the interior orifice type, and capable of washing the filters with water at the rate of 7½ gallons per square foot of filter surface per minute and with air at the rate of 3¼ cubic feet per square foot per minute. The lateral system is embedded in concrete, surfaced with a 1:2 mixture of Portland cement mortar. The air for the washing system is supplied by an air blower, located in the pump room. The blower has a capacity of 600 cubic feet per minute, against a pressure of 4 pounds per suare inch. It is driven by a squirrel cage induction motor, 3 phase, 62 cycles, 220 volts.

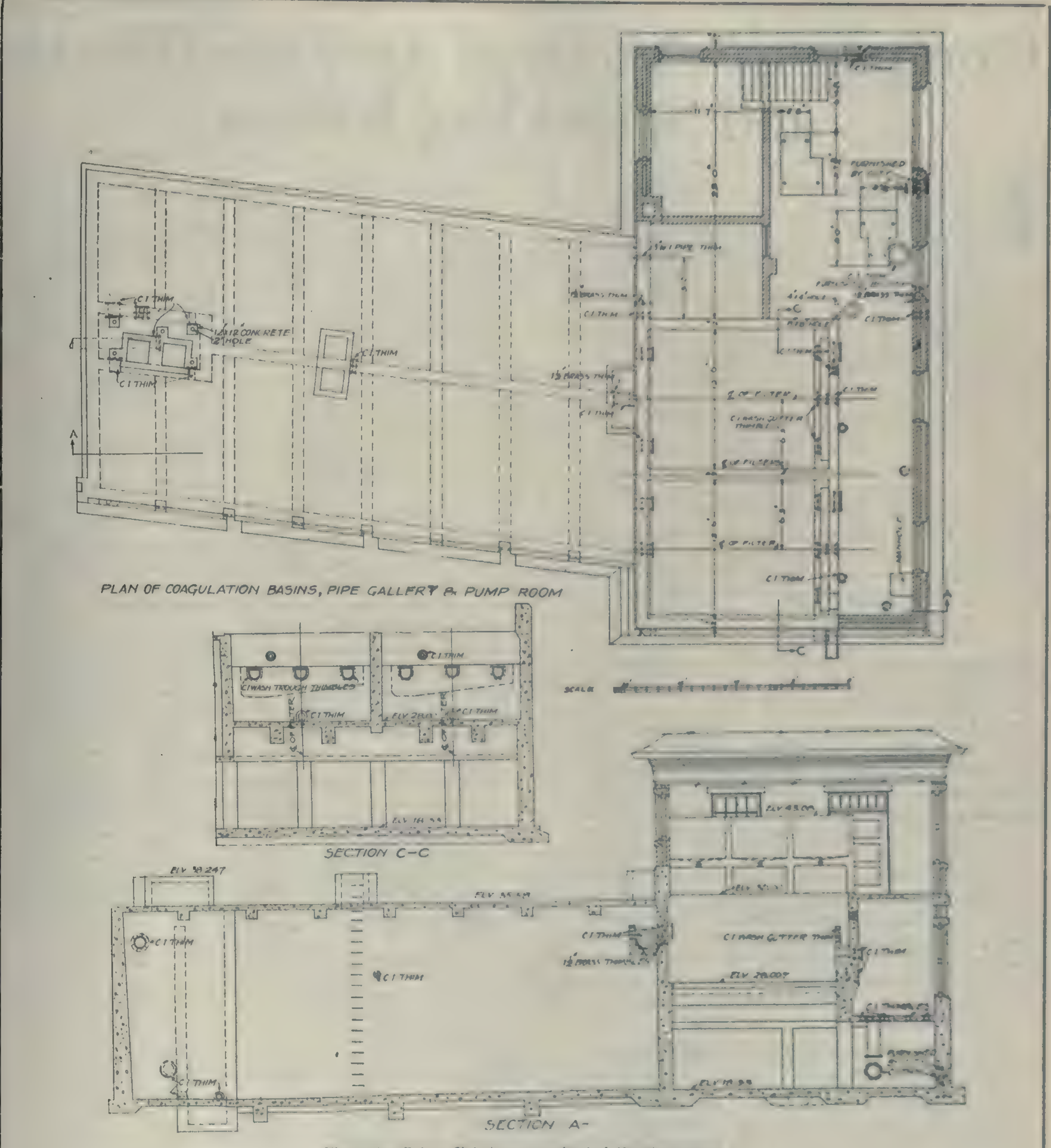
For removing the dirty water three longtitudinal wash water gutters are installed; these lead to a concrete cross channel at the front of the filter; they also serve to distribute the raw water over the filter surface during filtration. The gutters are so set as to draw the water evenly from all parts of the surface.

Rate controllers, Venturi type, are placed on the effluent pipe from each filter; the normal capacity is 450,000 gallons per 24 hours, but the controllers are capable of adjustment for rates of discharge varying from 400,000 to 800,000 gallons. Pipes lead from the filter into the clear water well, from where the water is pumped by the high lift pumps into the distribution system.

Pointe Claire Plant—Coagulation Basin in right foreground.

The operating tables in the operating gallery are of marble, with four way valves, and graduated dial indicating the position of the valve disc in the influent gate. The tables are also furnished with loss of head guages, (provided with electric alarms); also depth guages for showing the depth of water in the clear water basin. The water level control valve is provided with a hydraulic cylinder for opening and closing the valve. This is operated by a float controlled pilot valve, the float operating in a float tube in the pump room. The float tank is connected with the coagulation basins through a 1½ in. wrought iron pipe.

The apparatus for preparing the coagulant and storing the alum is on the second floor. The apparatus consists of dissolving grids, agitators, piping for two concrete solution tanks, water supply line to the dissolving trays and hose valve, drain piping from the tanks to the main filter drain, chemical outlet piping from the solution tanks to the orifice feed tanks, chemical piping from the feed tanks to the inlet chamber of the coagulation basins and to the effluent flume of the coagulation basins. The agitators are oak wood paddles attached to a vertical shaft, each shaft being



Illustrating Pointe Claire's new mechanical filtration system.

provided with a set of spur gears contained in a metal housing and driven by a vertical water motor. The alum solution is filtered before passing to the orifice feed tanks, which are provided with float operated control valves, and an orifice feed valve. The solution tanks have wooden guage boards graduated to show the depth of solution in the tanks as well as the fall of solution when the tanks are in operation.

To ensure freedom of the water from bacteria, it is treated by liquid chlorine before being distributed, Wallace & Tiernan apparatus being used for this purpose.

The wash water pumping unit and suction pump consists of a single stage centrifugal pump driven by an electric motor; it has a capacity of 1350 gallons per minute, the squirrel-cage induction motor having a no-load speed of 1875 r.p.m. The low lift pump is of the double suction split case volute centrifugal type, direct-connected to an electric motor. The pump has a capacity of 625 gallons per minute against a working head of 43 feet. The motor has a speed of 1250 r. p.m.

The shingles for the roof of the filter house were supplied by the Asbestos Manufacturing Co., Montreal, and the plumbing, heating and roofing was executed by Mr. J. J. Briard, Montreal.

Comparative Value of Activated Sludge and Sprinkling Filters

By T. Chalkley Hatton*

ECONOMY has played too large a part in the development of sewage disposal processes up to the present time. Among leading sanitary engineers in the United States to-day it is the almost universal practice to recommend dilution as an important part of any process of sewage disposal, even though dilution may render a natural water course unfit for many of the purposes to which a riparian owner might wish to apply it.

The argument advanced has been that the natural means provided by the water itself should be utilized so far as possible, so long as the riparian owners don't kick; and if they do kick, pay them their price, which is likely to be less than the cost of treating the sewage to such a standard that the natural purity of the streams may be maintained.

The author has always objected to this argument, especially in view of the propaganda rapidly spreading throughout this country for the "city beautiful," by which it is intended to provide all means for the comfort, health and general satisfaction to the citizens of a municipality. If, in accomplishing this, the foul emanations from the municipality are deposited upon its neighbors to annoy them, the "city beautiful" idea is, to say the least, inconsistent.

A few years only have elapsed since most of the street cleaning was left to the natural elements; when garbage was deposited upon ground near the municipality and nature invited to do the rest; when most communities used such a supply of water as might be most available without any artificial treatment; but educational progress has taught us that these practices are inimical to public welfare. Although the cost has been enormous, all well-governed cities now insist upon clean streets, clean and wholesome water and the disposition of garbage without nuisance. Is it not pertinent to ask why the slipshod methods usually practiced in partially treating sewage should not be abolished and the work done right, even though the price may be high?

What Process Will Eliminate Nuisance.

Those engaged in the art of sewage disposal are quite aware that disposal can be accomplished without causing a nuisance to anyone, providing expense is not to be the chief controlling element, and the writer believes that the profession will not enjoy the confidence of the public in sewage disposal matters until it insists upon having the disposal completed without nuisance to any legitimate rights.

This statement naturally brings forth the question as to what known process applicable to the average conditions will eliminate the nuisances to others caused by sewage treatment plants as now practiced.

It will doubtless be conceded by all readers that few, if any, of the present methods of sewage treatment produce a clear non-putrescible effluent; that all produce a sludge which is undesirable as a daily neighbor and that at times every such method produces odors which are neither pleasant nor wholesome; that the final disposition of the sludge is, after all, the greatest problem in a plant of any considerable size and that these disadvantages have been generally considered inseparable from the art.

With this concession granted it follows that a method of sewage treatment which will eliminate these disadvantages is most desirable providing the cost is not prohibitive and should be given very serious consideration in determining the type of plant most applicable to local conditions.

Comparison of Activated Sludge and Sprinkling Filter Processes.

All municipalities in America of any considerable size which have, during the past decade, considered the installation of sewage treatment works have studied fine or coarse screening, sedimentation, sprinkling filters and chlorination, either as units, couplets or in other combinations. Fine screening or sedimentation followed by sprinkling filters and final sedimentation, and in some instances chlorination, briefly describes the treatment now most generally recommended where a non-putrescible effluent is required, and may be taken as the last word in sewage disposal so far as American practice is concerned. The activated sludge process, as recently developed, should therefore be compared with the sprinkling system and auxiliaries and all others thrown into the discard.

In making this comparison, however, the taxpayer should not be given the primary consideration, but should be placed upon an equal basis with the other interests at stake so far as that may be practicable.

In comparing the advantage and disadvantages of the two processes of treatment the following main items should be considered:

Variation in standard effluent.
Area required for plant.
Loss of head through plant.
Effect of temperatures.
Length of main outfall sewer to plant.
Clarification.
Odors.
Flies.
Disposal of sludge.
Cost of plant.
Cost of operation.

Variation in Standard Effluent.

Both processes are susceptible of producing any standard effluent required. In sprinkling filters this can be done by varying the rate of flow through the filters. In activated sludge plants it can be done by the volume of air or contact period or both. This flexibility of either process is a valuable feature in many situations. With the suspended and settleable solids removed there are many periods during the year when a putrescible effluent might with impunity be discharged into running water swollen by spring freshets and polluted by surface scourings. Under such conditions the activated sludge process can be operated at decreased cost, whereas no saving can be experienced with sprinkling filters.

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* Chief Engineer, Milwaukee Sewerage Commission, in Municipal and County Engineering.

Area Required for the Plant.

A well constructed and operated sprinkling filter plant with filter beds from 9 to 10 ft. deep should produce a uniform non-putrescible effluent from the average American municipal sewage at a rate of 2,500,000 gals. per acre.

An activated sludge plant under like conditions with 10 ft. depth of aeration tanks, should produce 10,000,000 gals. per acre and with 15 ft. tanks 15,000,000 gals.

The area required for the auxiliaries (except sludge drying beds), connected with the two types of plants will probably nearly balance; so that the sprikling filter process will require from five to six times the area required by the activated sludge (exclusive of sludge disposal).

In the maority of cases this is a very important item. It is well known that even waste ground in the proximity of a municipality, when desired for sewage disposal purposes, automatically assumes values out of all proportions to its actual worth.

The Loss of Head Through Plant.

The loss of head through a sprinkling filter plant should never be less than 12 ft.; whereas an activated sludge plant can be operated successfully with a loss of head of from 2 to 3 ft. from the surface elevation of the sewage in the grit or screen chamber to the surface elevation of the effluent in the outlet conduit.

In many situations the difference in the loss of head required means installation of a pumping plant with the increased operating expenses, and when a pumping plant would be required in either case it means an additional lift of from 9 to 10 ft.

Effect of Temperature.

In climates north of the 42d degree parallel the efficiency of sprinkling filters is reduced from 25 per cent. to 33 per cent. during the three winter months. To provide against this, extra area of beds should be provided. So far as observed the efficiency of the activated sludge process is but little affected by climatic conditions, although the indications are that it does require more air or a longer contact period when the temperature of the sewage falls below 45 degrees F. The evidence so far obtained, however, is not conclusive.

Length of Main Outfall Sewer to Plant.

It will doubtless be conceded that a sprinkling filter plant should be located at considerable distance from present and prospective human habitation. This requires, in most instances, the building of a long and expensive outfall sewer to the plant.

On the other hand an activated sludge plant properly designed, built and operated can be built close by human habitations without creating a nuisance, because there are no odors, flies or other nuisances to offend the senses, which extend beyond the boundaries of the plant.

Clarification.

The effluent from the best operated sprinkling filter plant cannot be said to be clear. So far as the author has observed, its turbidity runs from 40 to 75. The effluent from a properly operated activated sludge plant will carry a turbidity of not more than 90 and usually 95 to 98. In fact the clarity of the effluent produced from this type of plant is one of the wonders which attracts both the learned and novice.

This feature is of decided advantage because it does to a large extent create in the minds of the public a confidence that a satisfactory treatment is being given to the sewage.

Odors.

There can be no doubt in the minds of anyone that sprinkling filters and their auxiliaries produce odors, at times, which are unpleasant and inimical to the comfort of persons coming in contact with them. These odors emanate from the preliminary settling tanks of whatever type, sprinkling filters and the sludge.

With a properly operated activated sludge plant no odors are produced which can be detected 200 ft. from their source. In fact, after operating a testing plant for 3 years, the author has not been able to detect any unpleasant odors 150 ft. from the plant, and yet the sludges produced have been reduced to a fertilizer base by methods where the necessary refinements for reducing odors were not used.

Flies.

Sprinkling filters produce myriads of flies and worms. It is questionable whether these become a nuisance to the surrounding neighborhood, but they do, at least, produce an unmitigated nuisance to those whose duties require them to work in and about the plant. Neither flies nor worms are produced about an activated sludge plant.

Disposal of Sludge.

In most instances the disposal of the sludge from a sewage treatment plant is the most difficult problem to solve. There are few locations where the sludges can be disposed of as easily and with as little nuisance as at Atlanta, Rochester or Fitchburg, although it must be taken into consideration that this ease of disposal was the result of constructing long and expensive outfall sewers, part of the cost of which should be added to the cost of sludge disposal when comparing the two processes.

Under the ordinary local conditions, whether the sludges to be handled are produced from plain sedimentation, hydro-litic, or two-story tanks, this handling involves, considerable labor, and costs, exclusive of overheads, from $2 to $5.50 per 1,000,000 gals. of sewage treated, so far as the author can determine from the meager information he has been able to accumulate.

The sludges produced from plain sedimentation, hydrolitic or Dortmund tanks are wet and putrid when exposed to the atmosphere, and must be lagooned, trenched, discharged upon low ground enclosed with dikes or desposited in separate digestion tanks; in every such case the odors arising from the decomposition are unpleasant and penetrating to a considerable distance.

The sludge from the two-story tanks is free from odors which carry to any considerable distance and can be removed from the tanks at such seasons of the year when climatic conditions are most favorable for drying. These are features which make the two-story tank attractive particularly in the northern sections of America, although there are but but or three months out of the 12 when the climatic conditions in the northern tiers of the United States are such that this sludge can be successfully dried within reasonable time, say from one to two weeks.

Even at the Baltimore plant, where numbers of

Table I—Construction Cost Comparisons of Sprinkling Filter and Activated Sludge Plants.

	Sprinkling Filter Plants,		Activated Sludge Plant.
Comparable Items.	Gloversville.	Fitchburg.	Houston.
Capacity of plant in million gallons	3	4	10
Total cost exclusive of land and engineering	$164,036	*$263,036	$301,526
Cost of plant per million gallons	54,680	65,700	30,152
**Approximate area in plant (acres)		4.17	1.0
Approximate gallons treated per acre	1,000,000	2,000,000	10,000,000
Approximate loss of head in feet	16	25.4	3.5

**Exclusive of ground required for final disposition of sludge.

*Exclusive of sand filters.

separate digestion tanks have been provided, large additions to the sludge drying beds have been made to enable the operators to get the sludge dried within the period of the year when it can be done successfully. In municipalities such as St. Paul, Indianapolis, Milwaukee, Chicago, Detroit, Cleveland, and other northern cities, where the volume of sludge produced would be of considerable magnitude, the author is of the opinion that the ordinary sludge drying bed for sludges produced from two-story tanks would prove a failure, and that the Pratt glass covered beds or some such scheme would have to be adopted.

Lagooning, trenching, filling low lands, digestion tanks or drying beds require surface area and this area must be added to the area required for sprinkling filters, and depends upon the character of soil in the first three types, and the normal climate and size of digestion tanks provided in the last two types. Sludge drying beds have generally been provided on the basis of one-half to three quarters of one acre per 1,000,000 gals. of sewage treated. To a plant treating a daily flow of sewage of from 5,000,000 to 10,000,000 gals. or less this additional area does not assume importance, but when the daily flow runs up to 50,000,000 or more gallons the area required for sludge beds and that for the final disposition of the dried or partially dried sludge is a matter of great magnitude.

Reducing sludges produced from sedimentation tanks of one type or another to a fertilizer has been attempted in many instances with more or less success. The most recent instance of any magnitude is the operation at Baltimore where the partially dried sludge which has accumulated from the sludge drying beds since the beginning of the operation of the plant is being reduced to a low grade fertilizer by a contractor who has installed a primitive drying plant consisting of direct heat dryers, grinders and screens.

Mr. Reuter, superintendent in charge of the plant, informed the author in September, 1917, that he was producing the dried fertilizer at a cost of $2.82 per dry ton, exclusive of overheads, that it was sold to the fertilizer dealers for $2.50 per unit of available ammonia, and that it contained from 1.25 to 2 units per ton. Not a very attractive business, it is true, but the trouble seemed to be twofold—the crude and expensive method necessarily used in much of the plant and the low grade sludge.

The author was impressed with the great benefit enjoyed by the city of Baltimore from this operation. It was getting rid of a sludge, without expense to the city, which threatened in time to cover all its available ground with an undesirable product. It was getting rid of it without nuisance to its neighbors, and was adding to the wealth of the community by conserving those fertilizing values which would otherwise be utterly wasted.

The disposal of the sludge from an activated sludge plant becomes entirely a mechanical or industrial problem, and must be so recognized to make the process applicable to any condition.

As a wet product there is far more volume to be handled than is produced from any other process of sewage treatment; probably three to four times as much as it produced from chemical precipitation. When fresh it is odorless but being highly organic, decomposition begins soon after it is exposed to the atmosphere, and this character precludes it from being dried in the atmosphere. It constantly accumulates and must be handled as rapidly as possible. There are disadvantages of no mean proportions connected with the activated sludge process.

On the other hand the sludge, when reduced to a fertilizer base, contains from 4 to 5 units of available ammonia, which, during pre-war times, was worth $2.50 per unit, and is now much more valuable. From experiments made in Milwaukee and Chicago it can be dewatered by means of pressing and drying at a cost equal to or less than its selling value, and its value as a fertilizer has been practically demonstrated by Dr. Bartow at the University of Illinois, by Col. Nasmith's and Dr. McKay's experiments at Toronto, by Mr. W. Jones, of Stourbridge, England, and by the author in the vicinity of Milwaukee.

The equipment necessary to handle the sludge from a 100,000,000 gal. plant would occupy approximately three acres and would consist of settling tanks, press, dryer and storage houses.

In comparison with the sprinkling filter process the

Table II—Comparison of Cost of Operating Sprinkling Filter and Activated Sludge Plants.

Comparable Items.	Gloversville.	Fitchburg.	Houston.
Capacity of plant—Basis for computation	3,000,000	4,000,000	10,000,000
Overhead, 5% interest, 2½% depreciation	$11.24	13.50	
Overhead, 5% interest, 3½% depreciation			$7.02
Operating costs, including sludge disposal	5.56	6.93	7.08*
Total costs per million gallons	16.80	20.43	14.10

*The total operating cost for reducing the sludge at Houston is estimated to be $8.40 per dry ton. One-half a dry ton is produced per million gallons of sewage. The value of the dry sludge is estimated at $11.25 per dry ton, or $2.50 per unit.

activated sludge process solves the sludge problem by compulsion without creating any nuisance to the neighborhood, and conserves those values of which the agricultural community always stands in need. This advantage is of value not only from the viewpoint of dollars and cents, but from the broader economic view of conservation.

Cost of Plants.

It is a difficult matter to compare the cost of any two disposal plants fairly on the basis of volume of sewage treated. There are local conditions which usually require added expense in one which do not prevail in the other. Unless these are well understood any such comparison is subject to doubt.

It is often most difficult to secure reliable innformation as to the actual cost of constructing a sewage disposal plant. The amount of contract can be determined, price of land occupied and cost of special machinery and equipment, but there are many other items such as engineering, inspection, superintendence and other contingencies entering into the cost which are so frequently omitted from any published statements.

For these reasons, and because the three plants chosen for comparison are, in the writer's opinion, the best of their type both in construction and in operation, he has taken the Gloversville, Fitchburg and Houston, Texas, plants. The first two are fine examples of the sprinkling filter type and the last the only large plant now built of the activated sludge type.

In comparing the cost of the plants the cost of the sand filter beds in the Gloversville plant has been omitted because it is not a part of the sprinkling filter system, but an auxiliary necessary for the treatment of the special character of sewage produced from the large number of tanneries, and is not common to other sprinkling systems; although it might be said that the sand filters tended to reduce the depth of the stone beds and to that extent reduced their cost.

The activated sludge plant at Houston has been in operation for about a year, at least the sewage treatment part of the process has been, the sludge reduction plant is now being installed, all necessary contracts therefore having been made under certain definite guarantees as to the cost of product, power, fuel and labor required.

It has been treating an average daily flow of 5,000,000 gals. of domestic sewage with little industrial waste and has been producing, according to Mr. E. E. Sands' written statement to the author, a relative stability of about 70.

The writer prefers to have his reader draw his own conclusions as to the advantages or disadvantages of the two methods of sewage treatment discussed in the article. He has presented the facts as they have been presented to him during the last three years of intensive study and observation of the sewage disposal problem. He believes, however, that the activated sludge treatment solves the problem far more satisfactorily to all parties concerned than the sprinkling filter process, where a stable effluent is required and where power costs are not excessive.

Fine Normal School Building

A FINE normal school building being erected at Nicolet, P. Q., by the community of the convent of the Assumption is now nearly completed. The building which is of solid brick and steel construction, consists of a centre part 137 ft. x 60 ft. with two wings 109 ft. x 45 ft. and is four storeys in height with sub-basement and large extension kitchen of one storey. The sub-basement of 8 ft. is used for cellar storage, coals and furnaces.

The first floor, 12 ft. high, contains two large recreation halls, refectories for pupils and sisters, class rooms and studies with kitchen and pantries. The second floor, 13 ft. high, contains principal entrance and parlors with community and professors' rooms. On the third floor, also 13 ft. high, are large concert hall and chapel, library and music rooms and infirmaries. The fourth floor of 13 ft. is utilized for dormitories and bedrooms with large hall in each wing.

New Normal School Building, Nicolet, P.Q.

Each floor is supplied with two sets of lavatories, great attention having been paid to the sanitary and ventilating arrangements. There are two staircases and fire escapes to each storey.

The interior is finished in selenite plaster on metal lath and the heating is furnished by four Sirdar furnaces; electric light is supplied throughout

The whole work has been carried out by the Company Caron, of Nicolet, at a cost of nearly $200,000.00 from the designs and under the superintendence of Mr. L. J. Caron, architect. The steel work was supplied by the Phoenix Bridge Works. The cornice work and metal roofing by Cyrille Labrecque, Quebec, and the cut stone work by J. D. Naud from the St. Marc quarries near Three Rivers.

Recent Developments in Industrial Research in Great Britain

By John Johnston*

THE commanding position held for so long by a large number of British industries had created a deeply rooted feeling of security among a large body of manufacturers; this, coupled with a natural conservation and with the circumstances that the heads of many industries have not been educated in such a way as to enable them to appreciate scientific knowledge, was a hindrance to the adoption of proposals for research work in industry there. It had not been generally realized that industrial conditions were changing, and that many of the conditions which originally enabled British industries to assume a pre-eminent position had ceased to exist. The war, however, brought this fact home, and required a change in attitude which otherwise would have required a very much longer period to achieve; directly, by the necessity of many lines of research work to the production of munitions and to the prosecution of the war in general; indirectly, by the fact that many firms were forced to adapt themselves to entirely different lines or methods of manufacture, many of which depended for their development upon research work. British scientific men had for years been pointing out the necessity for the greatly extended application of science to industry, but no definite action was ever taken until about a year after the beginning of the war, when a White Paper, signed by Arthur Henderson, at that time a member of the Biritish Cabinet, appeared.

Necessity of Promoting Scientific Research.

This document is entitled "Scheme for the Organization and Development of Scientific and Industrial Research;" its first paragraph is so pertinent that it is quoted here:

> "There is a strong consensus of opinion among persons engaged both in science and in industry that a special need exists at the present time for new machinery and for additional State assistance in order to promote and organize scientific research with a view especially to its application to trade and industry. It is well known that many of our industries have since the outbreak of war suffered through our inability to produce at home certain articles and materials required in trade processes, the manufacture of which has become localized abroad, and particularly in Germany, because science has there been more thoroughly and effectively applied to the solution of scientific problems bearing on trade and industry and to the elaboration of economical and improved processes of manufacture. It is impossible to contemplate without considerable apprehension the situation which will arise at the end of the war unless our scientific resources have previously been enlarged and organized to meet it. It appears incontrovertible that if we are to advance or even maintain our industrial position we must as a nation aim at such a development of scientific and industrial research as will place us in a position to expand and strengthen our industries and to compete successfully with the most highly organized of our rivals. The difficulties of advancing on these lines during the war are obvious and are not underestimated, but we cannot hope to improvise an effective system at the moment when hostilities cease, and unless during the present period we are able to make a substantial advance we shall certainly be unable to do what is necessary in the equally difficult period of reconstruction which will follow the war."

By this document the State had "recognized the necessity for organizing the national brain power in the interests of the nation at peace. The necessity for the central control of our machinery for war had been obvious for centuries, but the essential unity of the knowledge which supports both the military and industrial efforts of the country was not generally understood until the present war revealed it in so many directions as to bring it home to all. War has remained as much an art as ever, but its instruments, originally the work of the craftsman and the artist, are now not only forged by the man of science; they need a scientific training for their effective use. This is equally true of the weapons of industry. The brains, even the very processes, that to-day are necessary to the output of munitions were yesterday needed, and will be needed again to-morrow, for the arts of peace. This is the central fact which justifies the establishment of the new machinery in the midst of a struggle that is absorbing the whole energies of the nation in a way no previous war has done."

Advisory Council Established.

The scheme thus promulgated is designed to establish a permanent organization for the promotion of scientific and industrial research; it provides for a small advisory council, "composed mainly of eminent scientific men and men actually engaged in industries dependent upon scientific research," whose primary functions are to advise on proposals

"(1) for instituting specific researches;

(2) for establishing or developing special institutions or departments of existing institutions for the scientific study of problems affecting particular industries and trades;

(3) for the establishment and award of Research Studentships and Fellowships."

It is unnecessary to give further details here, except to state that the Council was directed to frame a program for their own guidance in recommending proposals for research, which "will naturally be designed to operate over some years in advance, and in framing it the Council must necessarily have due regard to the relative urgency of the problems requiring solution, the supply of trained researchers available for particular pieces of research, and the material facilities in the form of laboratories and equipment which are available or can be provided for specific researches."

In accordance with these instructions, the Council made a survey of the whole field, and as a preliminary measure gave aid and encouragement to a number of researches which were being carried on by various technical societies, institutions or committees. The list of researches, with which the members of the Society may not be familiar, is of interest:

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*Secretary, U. S. National Research Council. Paper before American Society for Testing Materials.

- Laboratory glass; optical glass; glass technology.
- Hard porcelain; refractory materials.
- Setting and disintegration of salts and crystallin substances.
- Tin and tungsten.
- Corrosion of non-ferrous metals.
- Properties and composition of alloys.
- Tool steel experiments.
- Statistical work in preparation of field for research in iron and steel.
- Methods of notched bar impact testing; hardness test for journals and pins.
- Flow of steam through nozzles.
- Rate of heat transmission from hot surfaces to fluids over them.
- Deterioration of structures of timber, metal, and concrete in sea water.
- De-gumming of silk.
- Heating of buried cables.
- Properties of insulating oils.

The main work of the Advisory Council, however, was concerned with the organization of industrial research; firstly because they felt "the paramount importance of arousing and securing the interest of manufacturers in the application of science to industry, and, secondly, because the influence of the war has created in industry an atmosphere conducive to the growth of new ideas, whereas it has unforunately made the prosecution of work in pure science and in its organization a matter of extreme difficulty." As its work along these lines developed, it became clear that a separate organization having its own estimates in charge of a minister responsible to Parliament was a necessity. Accordingly in December, 1916, there was established a separate Department of State entrusted with the organization of scientific and industrial research; and under this Department an Imperial Trust was created to hold, on behalf of the Department, the sum of one million sterling which Parliament had placed at its disposal to be spent over a period of five years or so. It was agreed that the money thus made available should be spent in the form of grants in aid of research undertaken by firms in any industry which may combine to conduct it on a co-operative basis; and that the best means to this end is the estabishment of Trade Research Associations.

A leaflet has been published explaining the manner in which such associations are expected to work, from which we take the following excerpt:

"The independence and initiative of the British manufacturer have contributed largely in the past to his success. After the war he will need all possible assistance in undertaking and developing research work as a means of enlarging his output and improving its quality. But if the help is to be effective, it must increase his independence and initiative. It must avoid chaining him to the routine of Government administration however efficient. It must be so given as to enlist his active support. To the initiative of the manufacturer, the improvement of old and the discovery of new industrial processes in this and other countries have largely been due. It has been the cooperation of progressive industry with science which has led to the practical application of the results obtained in the laboratories of scientific men. The Advisory Council for Scientific and Industrial Research have, therefore, recommended after consultation with manufacturers and others that the new fund should be expended on a cooperative basis in the form of liberal contributions by the Department towards the moneys raised by voluntary associations of manufacturers established for the purpose of research. By this method the systematic development of research and the co-operation of science with industry will be carried out under the direct control of the industries themselves. It is also hoped that the co-operation of the firms concerned in any one industry may enable research work to be undertaken which would not have been dealt with by individual firms.

Firms Must Co-operate to Improve Products.

"All considerations point to the necessity for combination to this end. If the firms in an Industry which are engaged in the production of similar articles, or alternatively if the firms in different industries which make use of the same or similar raw or semi-manufactured materials will combine to improve those articles or materials, the Department will contribute liberally to a joint fund for this purpose. The fund for each industry will be expended by a Committee or Board appointed by the contributing firms in that industry, and the results obtained will be available for the benefit of the contributing firms.

"The Department realizes that there will be many difficulties in the way. Some industries are more homogeneous in character than others, and could therefore agree more easily on the lines of investigation to be followed. Some industries are from their nature only interested in research because they are users of cretain materials which are susceptible of improvement, and these materials are also used by other industries. In some cases, accordingly, it may be possible to establish a Research Association for a whole industry, in others only a section may usefully combine, while in still other cases the most likely line of advance may be found in an association of firms in a number of industries which happen to use the same materials. It appears to be certain, however, from these considerations that some firms will wish to belong to more than one combination for research purposes, and that if wasteful effort is to be avoided, every possible means must be used to encourage co-operation between different research organizations as well as between the several firms within the same organization.

"But this will not exhaust the problems ahead Some firms in an industry will be in a better position to make profitable use of the results of research than others. All firms in an industry are not equally alive to the possibility of improvement, and each individual firm has its own views as regards the measure of the advantage to be obtained from research work in its particular branch of industry.

"All firms invited to join such an organization as is contemplated are likely to ask themselves what they are going to get out of it. They would not be efficient businesses if they did not. The answer to this question ought to give an outline sketch of the way in which such an industrial research organization would work. The means and method of its establishment will be described in later paragraphs.

"It is anticipated that each firm subscribing to a research organization will have the following privileges:

"(1) It will receive a regular service of summarized technical information which will keep it abreast of the technical developments in the industry at home and abroad. To do as much for itself any firm would have to employ more than one man on its staff reading and translating the technical press.

"(2) It will be able to obtain a translated copy of any foreign article in which it may be specially interested and to which its attention will have been drawn by the periodical bulletin.

"(3) It will have the right to put technical questions and to have them answered as fully as possible within the scope of the research organization and its allied associations.

"(4) It will have the right to recommend specific subjects for research, and if the Committee or Board of the research organization of that industry consider the recommendation of sufficient general interest and importance, the research will be carried out without further cost to the firm making the recommendation, and the results will be available to all the firms in the organization.

"(5) It will have the right to the use of any patents or secret processes resulting from all researches undertaken either without payment for licenses, or at any rate on only nominal payment as compared with firms outside the organization.

"(6) It will have the right to ask for a specific piece of research to be undertaken for its sole benefit at cost price, and, if the governing Committee or Board approve, the research will be undertaken

"It will be realized that no firm outside the organization will have any of these rights. The documents and bulletins available for members of the organization will not be published unless the controlling committee of the organization decide that they shall be.

Assessment in Proportion to Size of Firm.

"The method of assessing the subscription of each firm will have to be determined in negotiations with each industry or section of an industry which may agree to combine for the purposes of research, but the intention is that firms should contribute on a basis proportionate to their size. Thus the small firm will contribute less than the large firm, yet it will have the same privileges, though as a rule it will not in the nature of the case have the same facilities for exploiting the results of research. On the other hand the small firm will be more likely to use the benefits offered under heads (2) and (6) than the large firm.

"The Government contribution will be promised for a period of years to be agreed upon, not exceeding five, though it may be extended if funds are available and the condition of the industry calls for further aid. The contribution will be made in the anticipation that when the new organizations are once fairly launched on their career the need for direct State assistance will disappear, and British industry will be as self-sufficing in the field of industrial research as it has proved itself to be in other spheres of work."

The above paragraphs show the broad spirit in which the scheme has been conceived; the breadth of view of the Council is also evident in its remarks upon the constitution of the governing body or council a trade Research Association. "It is obvious that capital, management and science must have suitable representation. But we believe further that greater success and a wider scope of action will be obtained if provision is made also for the inclusion of labor. In most cases only skilled labor will be concerned. We think it important, however, that the workers in an industry should be able to ascertain at first hand how science is applied to industry and how funds devoted to this purpose are expended, and that they should also be able to urge the importance of research which would result not so much in pecuniary gain as in the increased health and comfort of the workers. . . We believe that (Joint Industrial) Councils so constituted as to be able to discuss with knowledge questions affecting both employers and employed would, if they could be brought to work successfully, greatly help the formation and development of Trade Research Associations."

Labor Benefits by Research.

Nor is it only from this side that the usefulness of research to labor is recognized; for in the very remarkable report on reconstruction by the sub-committee of the British Labor Party, they write: "From the same source (surplus wealth) must come the greatly increased public provision that the Labor party will insist on being made for scientific investigation and original research, in every branch of knowledge not to say also for the promotion of music, literature and fine art, which have been under capitalism so greatly neglected, and upon which, so the Labor party holds, any real development of civilization fundamentally depends. . . . Especially in all the complexities of politics in the still undeveloped science of society, the Labor party stands for increased study, for the scientific investigation of each succeeding problem, for the deliberate organization of research, and for a much more rapid dissemination among the whole people of all the science that exists. . . . What the Labor party stands for in all fields of life is, essentially, democratic co-operation; and co-operation involevs a common purpose which can be agreed to; a common plan which can be explained and discussed, and such a measure of success in the adaptation of means to ends as will ensure a common satisfaction." All of this reflects a very great change which promises well for better relations between labor and capital and for improved conditions generally.

Present Developments.

The foregoing sketch of the recent development of research, and particularly of co-operative research in Britain, will give some indication of what has been achieved there; though perhaps the most noteworthy point is the changed attitude on the part of manufacturers towards science and education, for without such a change little could have been accomplished. May I add that the general conditions which confronted Britain will soon confront us likewise, if indeed they are not already here; and suggest that their schemes be given careful consideration as being one means of securing greater efficiency in industry and greater economy in the use of our resources of men and materials?

The Building of Concrete Ships[*]

THE first thought of most engineers with regard to materials for the concrete for a ship is to use such as will provide the densest mixture possible. Concrete of high density also has a high unit weight. Our problem is fourfold: The concrete must be durable and impermeable to water; it must have a compressive strength of at least 4,000 lb. per square inch at 28 days, and a minimum weight. To meet these conditions we have determined upon the use of a rich mortar mixture.

Any standard portland cement which will meet the specifications of the United States Government may be used, provided the fineness is increased so that at least 90 per cent. will pass a No. 200 sieve. The greater fineness is required in order to obtain greater strength and a more plastic mixture. Such a cement is also more volume constant.

For the present the maximum-size aggregate is limited to ½-inch. A sand and gravel or a volcanic ash or specially burned clay may be used. The commercial future of the concrete ships is in large measure dependent upon obtaining a light-weight concrete. Investigations made are quite promising. The strength and weight of one of these mixtures which meets our requirements is as follows: One part cement, to one part special fused clay below ¼-inch size to two parts same aggregate between ¼ and ½-in. size, had a compressive strength of 380 lb. per square inch at seven days and 4350 lb. per square inch at 28 days. It weighed 106 lbs. per cubic foot in a saturated condition.

With the use of this material the ratio of the deadweight to total displacement will be 62 per cent. for the 3500-ton ship as compared with 65 to 68 per cent. for a steel ship and 53 per cent. for a wood ship.

No integral waterproofing compounds of any kind will be used in the mixtures.

Forms Must be Accurate.

The form problem is a most intricate and difficult one. The forms for practically the entire ship must be placed before concreting starts. The accuracy of placing must be much greater than in ordinary building construction for if the spacing is slightly oversized it results in increased tare weight of the hull, which, of course, decreases the cargo capacity of the ship. The relatively high unit stresses and the small thickness of covering for the steel also requires unusual accuracy in placing the forms.

There are a number of ways of constructing the forms. They may be of wood or metal, or of wood lined with metal. It has also been suggested that plaster forms may be used. They may be built in panels or as one unit, to be later removed. board by board. The inside forms may be first constructed and the outside forms placed after the steel is fabricated. A more common method is to place the outside forms first, fabricate the steel, and then place the inside forms. The former method is being followed in the construction of one ship for the Emergency Fleet Corporation, but the latter method will be used on subsequent ships. Much time and money can be lost or saved in forming and much thought and study can profitably be given to this work. In Norway there is one company building small craft by the so called "upside down" method, in which the inside forms are fabricated in an inverted position. The concrete is shot into place with a gun, or applied by hand, a relatively stiff mixture being used. No ships are being built by this method in the United States.

Reinforcement Small and Accurately Placed.

Reinforcing steel which we are using, other than fabric, is of rods or bars rolled from new billets to conform to the American Society for Testing Materials standard specifications for structural grade new billet steel. Plain round bars will be much easier to fabricate than deformed bars, but on account of the uncertainty of the effect of reversal of stress we are using deformed bars whenever the bond stress is high.

The accurate bending of the reinforcing steel is one of the most difficult of all the construction problems. With a wall thickness of only 3½ to 4 in., and two to three layers of steel, need for accurate bending of the steel can be readily appreciated. Furthermore, the curvature is constantly changing forward and aft in the vessel, which requires constant change in the location of the dogs on the bending table. The use of small steel is recommended, in that it is easier to spring into place if the bending is not accurately done.

With a very large quantity of steel, approximately equivalent to 10 per cent. of the carrying capacity of the ship, to be placed in a very small space in thin walls, there is much opportunity for the development of ingenious methods of fabricating the steel. Undoubtedly, much time can be saved by prefabricating, at least in part, the steel of the frames and placing them in the ship as units. These frames may be as much as 54 ft. in width and 35 ft. in height, and they must be accurate to within a fraction of an inch. Through a length of 60 per cent. of the ship the shape of these frames is constantly changing. All the steel must be supported and secured so that it will not touch the form surface. Numerous methods have been suggested, and there are a number of chairs now on the market for supporting steel, but all of them have objectionable features.

A study has been made of welding methods and machines as a means of avoiding the lapping of the steel. The acetylene weld is rather uncertain and not satisfactory. The electric resistance weld appears to be the most promising. Several machines of this type have been ordered and are now being tried out. The bond streses are exceedingly low in the longitudinal steel and there is more space available for lapping. In the frame steel, however, it is so close together that there is not room for lapping without increasing the thickness of some of the concrete members, which will in turn increase the tare weight of the hull. The weld by the electric resistance method can be made quite rapidly, and at small cost. It is not anticipated that welding any steel other than the main steel of the frames and possibly the main longitudinal steel will be required.

Rich mortar mixtures will be used, and they must be carefully proportioned and mixed in order to insure the quality of concrete necessary. Special attention should be given to the selection of the mixer, as all mixers of common types will not thoroughly mix mortars. The concrete should not be transported from the mixer and deposited directly into the forms in continuous operation or in large batches, on account of the danger of not having it thoroughly worked into place about the reinforcing steel. For the present it is required that all concrete shall be shoveled into the forms in order to insure its deposit in small batches and its thorough working into place.

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[*] Abstract of paper before American Concrete Institute, by Rudolph J. Wig and S. C. Hollister.

The actual placing of the concrete is a small item in the cost of construction of a ship, and therefore there should not be the incentive to rush the work as in ordinary building construction.

It is preferable to place the concrete as one continuous operation in order to avoid construction joints. This will require approximately three days (of 24 hours each) for a 3500-ton ship and six days for a 7500-ton ship. While it may appear difficult to work the concrete thoroughly around and through the reinforcing, no trouble is anticipated from this source. The rich, mortar mixture proposed is quite fluid, even though it is not mixed to a wet consistency, and with a slight tapping of the forms it settles readily into place about the steel. A number of test panels have been made, and the results in all cases have been entirely satisfactory. It is very different to make a construction joint in a section in which is embedded a large quantity of steel. Most leakage troubles occur at construction joints. The uncertainty of the bond obtained at construction joints is also objectionable on account of the large shear stresses. Several mechanical methods of placing mortar and concrete have received consideration, but the results of investigations do not up to the present warrant their use.

Treatment of Hull Surfaces.

It has been suggested by some that rough lumber be used for the outside forms, and a plaster coat be applied to the surface of the cast concrete. The application of such a plaster coat is not recommended, for the following reasons: The surface to be covered is very large, and the application of such a coat would have to be completed in a very short time. There is absolutely no way of assuring positively a perfect bond between the platser coat and the concrete surface. The application of such a coat will increase the weight of the hull without compensating advantages.

Barnacles and sea vegetation will adhere to concrete in the same manner as they develop on steel and wood. It is therefore necessary that the bottom of the hull be coated with some antifouling paint. The same paints can be used as are now used on steel ships, except that special means must be taken to insure a thorough bond. Investigation of a number of paints and coatings of different types is now being made. It is quite probable for the present that a bituminous coating will be employed on the bottom of the Government ships.

There has been much discussion relative to the advantages and disadvantages of constructing the ship on ways which will permit of side-launching or end-launching. Ways built for side-launching permit of the construction of the ship on an even-keel, thus making all the lines plumb. There have been very few accidents by sidewise launching of steel or wood ships, and it is believed the concrete ship can be safely launched somewhat earlier in this manner. In endwise launching the conditions of sagging or hogging depend upon the accurate positioning of the ways, and determination of the weight and conditions of buoyancy of the ship just before it leaves the ways. Slight settlement of any of the way piles may cause very serious hogging or sagging stresses. Two of the vessels being built by the Emergency Fleet Corporation will be launched endwise and the others will be launched sideways.

Certain of the equipment, such as the hawsepipe, stern frame, stern tube, etc., are cast into the concrete. The major portion of the equipment and all the machinery are secured to the concrete by anchor bolts. These must be accurately placed in the forms and completely detailed before the concrete is poured. Aside from the connections, the installation of machinery and equipment does not differ from the conditions met in either wood or steel ships. Wherever possible, through bolts rather than anchor bolts will be used. Under all deck machinery and fittings suitable waterproof gaskets should be placed so that there will be no leakage around the holding-down bolts. Too much attention cannot be given to the careful detailing of the fastenings and their exact location in the hull.

What is the Durability of a Concrete Ship?

If durability is to be obtained, special attention must be given to many elements of the ship. The most serious problem is to provide means of adequately protecting the steel from corrosion. There is a large quantity of steel embedded in the concrete and much of it cannot be covered by more than ⅝-in. of mortar. This of itself will not protect the concrete, particularly in the interior and in the upper portions of the hull. There are two means of allaying, if not wholly preventing, the corrosion of the steel. The steel may be galvanized or painted with some protecting medium which will not appreciably affect the bond, or the concrete may be coated with some thoroughly impervious membrane which will prevent both air and water from reaching the steel. A large number of tests are being made, and it is quite posible both methods of protection will be tried. The results are promising and a satisfactory protection should be developed.

Another possibly disintegrating element which may have great importance is the effect of constant reversal of stress, as the ship alternately is subjected to hogging and sagging stresses in a heavy sea. Our allowable steel stresses are such as to cause the concrete to crack. There are few analogous structures on land to which we can refer for guidance on this subject and only experience can tell what may be expected. Reversal of stress tests are now under way.

No trouble from chemical disintegration is anticipated except as the hull may be seriously abraded.

The Concrete Ship Department estimates the life of the concrete ship without any special protection at several years, and known methods which can now be applied should extend the life several years longer. It believes adequate protection will be developed to insure reasonably permanent life to the concrete ship.

The use of direct current on a concrete ship should be avoided wherever possible, on account of the possibility of electrolysis from stray current. A very small leakage for an appreciable tme, as demonstrated by the experiments of the Bureau of Standards, will cause a weakening of the mortar at the cathode, thus decreasing the bond strength. If the current leakage is large it may cause an oxidation of the steel at the anode, which will result in splitting and spalling of the concrete. The use of brass or bronze castings adjoining the concrete reinforcing should also receive consideration, on account of the possibility of local electrolytic action in the presence of the electrolyte.

With the quality of concrete being used no special provision will be needed to hold the heavier fuel oils. Investigations of various coating materials are being made with a view to their use as a lining if such is found desirable.

Sugar and certain vegetable oils, such as the cocoanut and peanut oil, will disintegrate the concrete if it is exposed for an appreciable length of time. If the ships are to be used in this class of trade, a projective paint coating should be applied to the inner surface of the hull.

The economy of the concrete ship cannot be determined until we have had experience over a term of years. The estimated cost of the concrete ship at the present time is approximately $125 per ton dead weight. The cost of a steel ship averages about $200 per ton, and that of a wood ship, $165 per ton dead weight.

If proper coatings can be developed to prevent deterioration, the concrete ship should be a competitor of the steel ship. With further experience it is believed the weight of the concrete can be very materially reduced, thus making the cargo capacity more nearly equal to that of the steel ship.

Sixteen-Inch Cast-Iron Well Casing Sunk by Floating

MORE than 500 ft. of 16½-in. cast-iron well casing was successfully sunk at the Chicago stockyards plant of Miller & Hart, Inc., by plugging the bottom and lowering in a water-filled hole to reduce the weight by flotation, according to a recent item in the Engineering News-Record. The process is a modification of a process for cast-iron casing deep wells developed by the Whitney Well Co., Chicago, contractors for well drilling, and is being used when longer strings of casing have to be sunk. This process consists of filling the drilled hole with torpedo sand or similar material, resting the pipe, plugged with a perforated disk, on the sand, and pumping the sand out to let the casing settle gradually.

Cast-iron casing, with cast couplings of semi-steel, of the size used at the stockyards well, weighs about 120 lb. per foot. Its advantage is its resistance to corrosion as compared to steel casing, and its disadvantage is its greater weight. This great weight has been regarded in the past as an insuperable obstacle to its general use, so that the examples here noted of successful sinking record an important advance in deep-well work. Cast pipe requires a straight hole since, unlike steel casing, it will not flex and follow a hole out of true. The stockyards work, therefore, was unique in the perfection of the drilling as well as in the use of cast pipe of large diameter.

The sinking was done with a standard oil-well rig. Through the surface, about 60 ft., a 24-in. hole was used, then a 19-in. hole through limestone and shale to 557 ft. This was the portion cased with the 16½ in. cast pipe. Between 990 ft. and 1040 ft. a soft layer was cased with 12-in. pipe. The remainder of the 1621 ft. of the well was uncased.

Mr. H. S. VanScoyoc, publicity manager of the Canada Cement Company, Montreal, is now on a visit to Western Canada. While in the West he will look after the business interests of the company.

Mainly Constructional

East and West—From Coast to Coast

Several cars of asphalt have been received and the work of surfacing Queen street, Sault Ste Marie, Ont., is now progressing.

Doon Estates, Limited, has been incorporated with a capital of $20,000, head office in Toronto, and is authorized to carry on business as a land and building company.

During July building permits to the value of $29,900 were issued in Galt, Ont. For the seven months of the year the total is $109,935, an increase of $37,000 over the corresponding period in 1917.

The Alabastine Co. are erecting a double house of gypsum blocks near their works in Paris, Ont. So far as is known this is the first time the gypsum blocks have been used for this purpose in Canada.

The waterworks tower at Tillsonburg, Ont., was recently destroyed by fire. The loss amounts to over $50,000, partly covered by insurance, and the town has been left without water for domestic or lawn service.

During the month of July there were 153 building permits issued in Winnipeg at a value of $227,000. This is a considerable increase over the same month last year, when there were 106 permits issued at a value of $164,000.

Work has been commenced on a new building for the Merchants Bank at the corner of Queen St. and Ontario Ave., Niagara Falls, Ont. The structure is to be rushed to completion as quickly as possible. Mr. Hewlitt is the contractor.

A special committee appointed by the council of Kent county, Ont., to consider the construction of a highway to the village of Erieau, have gone over the route in question and are favorable to going ahead with the project as soon as possible.

The Eastern Ontario Good Roads Association has planned a big good roads meeting to be held in Ottawa during Central Exhibition week, when it is expected to have Sir William Hearst, Hon. Finlay McDiarmid and several of their colleagues present.

Another concrete vessel, the Concretia, has been given a trial trip and has shown excellent behavior. She was launched at Montreal and made the voyage to Cornwall, Ont., in a few minutes under twenty-four hours, attaining an average speed of 10 knots per hour.

The Waterworks Commissioners of Guelph, Ont., are considering the question of installing an auxiliary pump, driven by electricity. The cost of the installation would probably be about $16,000 or $18,000. The matter, however, is as yet only in its tentative stages.

Letters patent of incorporation have been issued to the Molybdenum Products Company, Ltd., with authority to operate mines, work mineral deposits, treat ores, etc. The head office of the company is at the village of Wilbeforce in the county of Haliburton, Ont., and its capital is $1,075,000.

Vancouver building permits for the month of July number 93, and are valued at $132,153, as compared with 46 at a value of $27,602 for the same month last year. The total for the first seven months of 1918 is 465 permits, value $798,008, as against 307 valued at $351,196 for the corresponding period in 1917.

Arrangements have been made between the [illegible] and the B. C. Provincial governments whereby the former is immediately to undertake the construction of the Canadian Northern Pacific railway terminals on the Songhees reserve, off the Pacific Coast, also the laying of seventy miles of steel rails on this island.

The city of Brantford has offered to build a purification plant at a cost of $40,000 to be rented to the Dominion Gas Company, with the stipulation that the price of gas be not raised over 60 cents per 1,000 cu. ft. A counter-proposal has been advanced by the company that the city guarantee unsold bonds to the extent of $65,000, to finance the completion of the company's central purification plant at Glenwood.

According to rumors current in Porcupine, Ont., it is probable an addition will be made to the mill of the Davidson property. The small mill which has been in operation for some time is giving good results, but is insufficient for the ore being developed. The shaft is being continued to the 600-foot level, and a level will be established at the depth of 500 feet, where good ore has been indicated by diamond drilling.

About 30 men are now engaged at the Ankerite mining property of the Coniagas Mining Company of Porcupine, Ont. The work being undertaken consists of opening up a level at the 350-foot depth. Most of the lateral work done to date has been on the 200-foot level. Mr. Douglas Mutch, formerly of the Dome Lake, is in charge of operations at this property, and an extensive plan of development is understood to be contemplated.

Under agreement with the St. Thomas Cemetery Company, the D. W. Mitchell Mausoleum Company, of Toronto, is to erect a mausoleum in St. Thomas at a cost of approximately $45,000. The new building will be about 130 ft. in length by 70 ft. wide, and will be faced with Bedford stone and finished in the interior with polished marble. The foundation and superstructure will be of reinforced concrete. The capacity of the mausoleum will be two hundred or more bodies.

Members of the Ottawa Retail Merchants' Association and municipal officials of Ottawa and Carleton county recently made a trip of inspection of New York state roads, visiting Gouverneur on their way, where there was a special dinner arranged, and representative farmers and retail merchants of St. Lawrence told the party about the effect of good roads on business and agriculture. Alderman Findlay of Ottawa, who has been so active in good roads matters, was responsible for the organization of the trip.

Dredging work is proceeding on the Fraser River. The King Edward dredge earlier in the year had started to cut a new channel at Woodward's Landing, at a point where the official channel takes a wide curve and was silting up while the water showed a tendency to open out for itself a new and more direct channel. Later, when the freshet began to bring down a quantity of drift wood, the dredge was taken off this job, and recently has been working at Steveston. Just a short time ago, however, it has returned to the operations at Woodward's Landing.

Work is commencing on an extension to the Pacific Great Eastern Ry. in the vicinity of Clinton, the intention being to lay tracks for a distance of some 57 miles north of that point. The completion of this roadbed this year is part of the programme to finish the line to Williams Lake or Soda Creek by the fall of 1919, and when this whole project has been accomplished the P. G. E. Ry. will connect with navigation on the Fraser river and will be in a position to serve the entire surrounding country. Construction of a Hydro-electric plant of 400 horsepower at Squamish to serve the roundhouse and machine shops and also to supply electric light is also to be undertaken without delay.

A Palpable Error

Mr. T. Harry Jones, city engineer of Brantford, has drawn our attention to an item in our issue of July 31, in which we credited a piece of bad roadway to Colborne St., Brantford, instead of to Colborne St., Simcoe. We are glad to make the correction, though Mr. Jones' work in Brantford is so well known that an error is evident at first glance. Mr. Jones makes the matter quite clear in the following letter:

Brantford, Ont., August 8th, 1918.

Editor Contract Record.

My attention has been called to the following item in your issue of July 31st in the "Mainly Constructional" column:

> "The Colborne Street concrete roadway, Brantford, Ont., laid in 1916, is rapidly going to pieces, having been laid without city supervision. It is claimed that an insufficient quantity of cement was used, and that it will be necessary now to coat it with asphalt as the only means of preserving it at all."

There is not one word of truth in any of these statements. We have no concrete roadway on Colborne Street. All the concrete pavements in his city were not only laid under City superjvsion, but by the City itself, and they are all in splendid condition.

Yours truly,

T. Harry Jones,
City Engineer.

Personals

Mr. F. W. Field, British Board of Trade Commissioner, has just completed a tour of all Ontario manufacturing centres.

Mr. W. P. Gross, a member of the staff of Mr. C. C. Worsfold, the government resident engineer, has been placed in direct charge of the dredging operations on the Fraser River.

Mr. W. S. Fallis, who has for a number of years, with headquarters in Winnipeg, been western manager of the Sherwin-Williams Company of Canada, Limited, has just been appointed managing director of the company. Mr. Fallis is removing to Montreal to take up his new duties on the 1st of September. He started with the company in 1899 as travelling salesman in western Ontario and, through a series of promotions, has worked up to his present prominent position.

Mr. W. S. Fallis.

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Industrial Procedure Applied to Warfare

THE industrial development of the later years of the pre-war period was convincing proof that we have arrived at the age of the specialist. This condition was, of course, realized long since by all of those actively engaged in industrial work, but outside of this class, the public were slower to realize the change. It is due, chiefly to this changed condition that the Canadian industries have developed with such wonderful rapidity and now stand on such a firm basis.

Now it is noticeable that our Canadian Corps at the front are officered and manned by the men who were responsible for the development of our industries and it is not remarkable that they have carried into practice in the army the ideas which proved so successful in their civil life. To this grey matter, plus red blood, we owe the wonderful success of our fighting divisions in France, as well as the leading position universally conceded to our Forestry Corps, Railroad troops, our Engineers and Pioneers.

The old-time, jack-of-all-trades type of soldier is a thing of the past. He used to be known as the all around soldier. To-day every man is a specialist, specially trained in some branch of scientific warfare. Each of our divisions has its divisional schools at the front and they are constantly grinding out the supply of specialists in offensive and defensive warfare.

Every man has a special course of training in the work he is best adapted for. This is in addition to the general intensive training that each unit undergoes. If a man shows special ability in throwing a hand grenade, he is sent to the bombing school where he has a complete course in hand and rifle grenades. He learns all there is to know about every type of grenade, embracing the history of grenades back to the first record we have of their use in the early days of the Chinese empire. He is instructed in the construction of the various types, the different kinds of explosives used, and the methods of detonating each one.

Other men take courses in trench warfare, gas, wire entanglements, field engineering, etc., which are most comprehensive and thoroughly embrace every angle of the subject.

The units are as thoroughly organized as the departments of a big industrial business. Each unit is complete in itself and responsible to the larger unit of which it forms a part. The accounting and office systems in use are in many cases adaptations from those in use in our mills, factories and other organizations in Canada.

The present war demands the closest co-operation between the different arms of the service and for this reason the men as well as the officers must have a complete knowledge of what is expected of them before going into action.

Not many years ago a solder was told not to think, but to obey. This idea has been exploded. Brains are as useful in the business of war as in any other business. Training as a specialist in his chosen branch, and a knowledge of what is going on around him in an engagement makes a soldier think and this means he is better prepared for any emergency that may arise. Hence the initiative of the Canadians that is so often referred to.

The Peace River District

THE Peace River District has been for many years the subject of much interest and speculation. Alluring tales from adventurous pioneers, of its wonderful resources, charming climate and varying scenery, have long since lent to the district that charm of romance which distance and uncertainty blended with glowing promises. Now, however, the land so long famed by legend and mystery is being proved a reality, modern transportation having, so to speak, brought it to our very doors. A journey from Edmonton to the town of Peace River for instance, which five years ago consumed nearly two weeks of toil and hardship may now be made in less than twenty-four hours, in comfort at all times of the year, trains to this latest settlers mecca which is nearly 1,000 miles north of the international boundary line, carrying both sleeping and dining car accommodation.

The Department of the Interior, through its Natural Resources Intelligence Branch has prepared and is distributing a new illustrated report on the district based on investigations made by an official of that Branch during the season of 1917. The publication contains interesting information with regard to climate, soil, agriculture, minerals, game, water powers, transportation, and education. A map of the district showing general topography also accompanies the report.

The recent reservation in the interests of soldier settlement of available Dominion lands has also necessitated the preparation of a map which would show the area in Northern Alberta that had been reserved for such purposes. This publication is now available for distribution and should prove of considerable value to the returned soldier who is considering the advisability of settlement in the Peace River Country, likewise, to the prospective homesteader as it shows the area within which homesteads may be procured, also the total number of quarter-sections that are still available in each township within reasonable distance of a railway. A copy of the report or map or both may be procured free of charge upon application to the Natural Resources Intelligence Branch of the Department of the Interior, Ottawa.

Woodstock, N.B. Filtration Plant

WORK is progressing rapidly on the new filtration plant at Woodstock, N.B., and it is hoped to have it in operation on or before October 1. The building which is to house the sedimentation basins and filtering apparatus is of reinforced concrete, six carloads of cement and 25 tons of steel being used in its construction. Mooney & Co. carried out the contract for this structure. The portion of the building containing the sedimentation basins is 52 ft. long, 17 ft. wide and 16 ft. deep, while the compartment in whch the filter equipment is to be installed is 27 ft. long, 36 ft. wide and 16 ft. deep. The stone from the excavation of the building has been used as a breakwater to protect the property from ice. All the plant required, including air blower, filter washing apparatus, is to be supplied and installed by the Jewel Filtration Company of New York. The capacity will be 1,000,000 gallons per day. Engineer A. K. Grimmer has complete charge of the undertaking.

In the power house, which has been remodelled from the former pumping station, the following new units have been installed; one low lift steam turbine pump, with a capacity of 1,000,000 gallons a day; one high lift steam turbine pump with a capacity of 900,000 gallons a day; one gasoline driven turbine pump with a capacity of 800,000 gallons a day; one motor-driven low lift centrifugal pump, capacity 1,000,000 gallons a day; also a motor driven pump connected with the river in case of necessity. Besides this equipment, there is a previously installed, high lift motor driven centrifugal pump, with a capacity of 800,000 gallons per day.

Water Powers on Peace River*

Many misleading statements have been published relating to the vast amount of power available on the Peace river. This river, from the canyon in British Columbia to Vermilion chutes in Alberta, a distance of approximately 500 miles, is a wide swift river flowing over a sand or gravel bed, generally shallow, and through a deep valley, with gently sloping sides. The river is a mountain stream, as are many of its tributaries, and as a result the flow is very irregular, varying as much as 50 to 1 between high and low water, with the floods occurring during the summer months and the low flow during the winter.

On the Peace river there are two possible power sites: one in the headwaters at the canyon, and the other at Vermilion chutes.

The canyon site has not yet been investigated by the department's power engineers, and while the total fall through the canyon, which is about 18 miles in length, is reported to be between 225 and 275 feet, it is not known how much of the total head can be developed. In any event, a power development at this site will be an expensive undertaking, and can only be accomplished when a market for the power is available close at hand.

The Vermilion chutes site has been surveyed and investigated by the department's power engineers. The river at this site averages one mile in width, and takes a drop of 30 feet in a distance of 2 miles. The fall is concentrated chiefly at two points; the first or upper fall being in the form of a rapid, half a mile in length, with a total drop of 11 feet. The second drop is situated one and a half miles below the rapid, and is an abrupt drop of 13 feet over a limestone ledge, and is commonly called the "chutes."

At the "chutes" both river banks are low, and an effective head of 30 feet is about all that can be obtained. The continuous 24-hour power available, based on one season's discharge records, amounts to 19,100 horse-power. For nine months of the year possibly 27,300 horse-power can be developed.

The possibility of developing small blocks of power on the tributaries of the Peace has not been definitely investigated by the department's engineers. Of these tributaries, the Pine, North Pine, and Smoky rivers have their sources in the mountains and foothills and are fed by the melting snows in the mountains during the summer months and have only a small run-off during the winter. The Moberly, Pouce Coupe, and Bear creek, together with the tributaries below Peace River Crossing, depend upon the precipitation; are subject to floods during the spring and summer months, and have a very small flow during the winter. Further investigations may, however, reveal the possibility of storing and conserving the flood waters on many of these streams. In such an event, these streams will be capable of producing sufficient power to operate small mills, and in some cases supply the power demands of a small municipality.

The inherent disadvantages of the Peace river and its tributaries as a source of power at the present time are:—

1. The irregularity of flow.
2. High cost of development.
3. Absence of market.

These disadvantages may, however, be overcome by:—

1. The creation of storage reservoirs to regulate the flow.

2. By settlement in the district. As the district becomes thickly populated and towns spring up transportation facilities will be greatly improved and a market created for the power.

The Dominion Bridge Company, Limited, Montreal, has been awarded the contract for building two large Coal Handling Bridges of the traveling bridge type, equipped with clam shell buckets, for the Department of Naval Service H. M. C. Dockyard, Halifax, N. S.

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*From recent Government Report

The Briquetting of Western Lignites

By R. A. Ross, E.E.[*]

ALTHOUGH the fuel resources of Canada are enormous and varied, their geographical distribution is such as to leave the region between the Atlantic bituminous coal deposits and the lignite deposits of Saskatchewan destitute of all natural fuels save peat and wood. Hence the Provinces of Quebec, Ontario and Manitoba must be supplied in large part by importations from the United States, supplemented by shipments from the Eastern and Western Canadian coal areas. High freight rates are an inevitable concomitant of this condition.

As more than half the coal used in Canada is imported from the United States, and as nearly all is used in this naturally coalless region, our dependence upon the United States constitutes at once an industrial menace and a national problem. Fortunately this problem is capable of solution. Superabundant unutilized water powers can provide ample energy for industrial requirements in Eastern and Central Canada. Farther west the feasibility of meeting requirements in Saskatchewan and Manitoba by utilizing prepared lignites and sub-bituminous coals is the subect of this report.

Throughout the West, and especially in Saskatchewan, the domestic fuel situation is difficult. Either the householder must use the native lignite and sub-bituminous coals of the district, which would be unacceptable to the householder in the East, or he must pay even in normal times from $10.00 to $15.00 a ton for anthracite coal from Pennsylvania. As a matter of fact, the westerner does use about 500,000 tons of anthracite per year in this district at a cost of about $6,000,000.

In addition to this coal imported for household use, a large amount of the native coal is used on account of its cheapness; but as it is dirty, friable, and disintegrates rapidly, it presents no advantage for domestic purposes other than cheapness.

Underlying the province of Saskatchewan are immense deposits of very poor lignites. Better lignites and bituminous coals occur in Alberta. For the utilizing of these fuels in the most effective way for both domestic and commercial purposes, commercial preparation is necessary. For years past, Germany has burned practically no raw coal of any description; the raw product when mined being either briquetted or coked; the by-products together with the resulting fuel being of more economic value to the community than if the coal were burned without recovery processes, as is the practice on this continent.

When the Honorary Advisory Council for Scientific and Industrial Research was formed one of the first problems to attract attention was that of fuel. The situation in the North West in winter time, complicated as it is by stoppages of mines due to strikes, shortages of fuel due to lack of transportation, storms, etc., presented a field for useful work.

A review of the records of the Dominion Mines Branch and various Provincial departments, and of the reports made from time to time by Commissions and individuals both in this country and in the United States, indicated the commercial possibility of transforming the lignites of Saskatchewan into a marketable equivalent of anthracite coal.

Analysis of recorded facts demonstrated that preliminary carbonizing treatment, by which two tons of the raw lignite was converted into one ton of cake and then briquetted under pressure with the aid of a binder, gave better results than any attempt to briquette the raw material itself.

It may be stated in passing that some of the German brown coal can be, and is, briquetted without binding material; but it has been found that this is not possible in the case of the lignites of Saskatchewan and North Dakota. What little pitch they contain has to be supplemented by some effective binder to produce a sound briquette.

During the carbonizing process, the moisture is first driven from the coal, then the gases, and, still later, distillates which yield ammonia, oils, and pitches, all valuable products, so valuable, in fact, that for years past Germany has coked all her coal and saved the distillates and gas.

While these by-products are valuable, their value has not been considered in this respect as it was felt that the quantities which might be recovered would depend upon how far it is advisable to lessen the fuel efficiency of the briquetted product.

A final report suggesting action was then presented to the Research Council by the Lignites Committee. As this report contains all the details of the project, it is considered desirable to add it to this general statement.

After due consideration by the Council, the report was accepted, and representations were thereupon made to the Government requesting an appropriation of $400,000 to be expended on a plant of about 30,000 tons capacity of briquettes per year; the whole to be handled as a company on a commercial basis during both construction and operation, raw materials being purchased, and the finished product sold with reference only to commercial results, but without profit to the directorate.

It was anticipated that about one year would be necessary to complete the plant, and that thereafter possibly six months would be required for adjusting machinery, experimenting with various binders and mixtures, determining suitable temperatures for distillation under commercial conditions and the quantity of gas and distillates to be driven off.

At the expiry of this period it was expected that project would be on a commercial basis and that finally the equipment would be operated by the Dominion Government as a producing plant or sold to the Provincial Government or to private individuals, or used as an experiment station for briquetting other fuels.

Briefly, summarizing the report, the financial aspects of the proposition are as follows:

Total capital invested in lands, buildings, machinery, interest and management during construction, etc.	$400,000.00
Cost per ton of briquettes at the mine, including all fixed charges, amounting to 20 per cent on the capital per ton	7.00

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[*] Extracts from Report to Advisory Council

Cost of anthracite coal f.ob. cars
Estevan during normal times..
..........................$10.00 to $12.00

The above estimates imply that briquettes can be profitably manufactured in Saskatchewan, on a relatively small scale, without taking into consideration the value of by-products, at from $3.00 to $5.00 per ton less than the cost of Pennsylvania anthracite at the same spot.

It may be fairly expected that in the future, with larger plants in operation, profiting by the experience gained in this proposed establishment, briquettes will be produced at a very considerable reduction of the estimates there presented.

This project having been approved by the Research Council, was in June, 1917, presented to the Government with the request for official sanction. After a full consideration of this report the Privy Council reconmmended on March 20th, 1918, that this project be undertaken by the Government in co-operation with the Governments of the Provinces of Manitoba and Saskatchewan on the conditions that the two Provincial Governments together contribute half of the amount to be expended and that the direction and management of the undertaking be vested in a commission appointed to that end by the three Governments.

The Situation.

1st. The fuel resources of the Dominion of Canada are second only to those of the United States, the greatest coal country in the world.

2nd. In spite of this fact, Canada imports at present and always has imported—50 per cent. of her fuel from the United States.

3rd. Canadian efficiency in this regard is therefore, about 50 per cent.

4th Under these conditions the problem must be attacked, preferably by the Government, and not by isolated commercial agencies working in competition with each other.

5th. An examination of the map will show the Canadian territories supplied by coal distributed from various centres and indicate an immense area whose requirements are met from American sources.

6th. The province of Saskatchewan, as will be seen, is the balancing point for fuel from the East and from the West, and for this reason fuel prices are the highest, although underlying a great part of this province are immense deposits of lignite awaiting use.

7th. We, therefore, recommend that the attack on the fuel problem of Canada be concentrated first on the production of domestic fuel from the lignites of Saskatchewan for the following reasons:

(a) Because the price of anthracite coal in normal times in this district is the highest and runs about $15.00 per ton.

(b) Because successful briquetting of the lignites of Southern Saskatchewan with also solve the problem of briquetting the higher grade lignites of Alberta.

The Lignites.

Coals for commercial purposes are arbitrarily grouped as follows: Anthracite, semi-anthracite, bituminous, semi-bituminous, and lignite. All of these are available in this country in greater or less degree.

The manufacture of the lignites into briquettes in the manner proposed constitutes an artificial method of raising a very low grade fuel to the highest grade with the production of gas and other valuable by-products, no allowance for which is made herein.

1st. Various grades of coal, from anthracite in the Rockies to poor lignites in Southern Saskatchewan underlie a large part of the provinces of Alberta and Saskatchewan, whereas further East we have no coal deposits until the Maritime Provinces are reached.

2nd. The raw lignites of Southern Saskatchewan when taken from the ground contain about 40 per cent. of water which must be eliminated by air-drying, or evaporated in the furnace at the expense of the heat value of the fuel .

3rd. This condition renders the raw fuel unsatisfactory for domestic use, both on account of the cost of transporting the water and of its evaporation. The fuel is impure, falls to pieces if stored, and can only be utilized when freshly mined.

4th. An examination of tables available indicate the relative positions of lignite as mined, briquettes of carbonized lignite, and anthracite, in the scale of heating values. When the other factors of operation, such as loss through grates, etc., are considered, it is safe to say that the heating value of the lignite as mined is increased 100 per cent. by carbonizing and briquetting.

5th. Raw lignites are briquetted commercially in Germany, but so far it has not been found possible to handle the lignites of North Dakota and Saskatchewan in this way, nor in view of the situation to-day is it advisable to do so even if it were possible.

6th. By carbonizing the lignite a coke or charcoal is obtained which briquettes readily, has a high heat value, and by-products such as tar, ammonium, sulphate, gas, etc., are recovered.

7th. Without consideration of the by-products the result has been to turn two (2) tons of poor fuel into one (1) ton of fuel approximating anthracite in caloric value with practically the same actual heating value in the domestic furnace as the two (2) original tons from which it was made.

8th. After carbonizing, briquetting can only take place through the agency of a binder for which coal-tar pitch and sulphite pitch have been successfully used. Sulphite pitch, a waste product from pulp mills, is available in immense quantities. The only purpose which it subserves at the present time is that of poisoning fish in the various waters near which pulp mills are situated.

9th. After carbonizing and briquetting, the fuel must be waterproof. This is accomplished by a simple heat process resulting in the coking of the binder.

Present State of the Art of Producing Carbonized Lignite Briquettes.

The processes involved in the manufacture of carbonized lignite briquettes have all been carried to a stage beyond that of the laboratory. The next step forward involves commercial methods of production on a scale sufficient to demonstrate the best production methods and the costs.

1st. Briquetting of the raw lignites of Central Europe, especially those of Germany, has been carried on successfully for years past, the output for 1913 in Germany being 20,000,000 tons.

2nd. The briquetting of bituminous slacks and small sizes is carried on in several parts of the United States in a commercial way at the present time.

3rd. The briquetting of anthracite slack in British Columbia has been a practical success for some years past both for domestic and locomotive fuel.

4th. The carbonizing of North Dakota lignites has been carried on at Herbon, N.D., in a semi commercial way, and carbonized Souris lignite has been produced at Estevan on a small scale.

5th. The briquetting of these lignites, however, has not been carried on in a commercial way, any briquettes made being produced sporadically in carload lots, sufficient in amount only to demonstrate that briquetting is practicable.

6th. Carbonizing is a simple process and sufficient information and experience has been obtained to warrant commercial production.

7th. Briquetting and suitable binders require study upon a commercial scale in order to determine temperatures, pressures, mixtures and results in actual practice.

8th. The necessary waterproofing, which is obtained by a heat treatment ofthe completed briquettes, presents no difficulty whatever, being a simple matter of coking the binder at a low heat.

9th. Summing up, the producer must face the difficulties inherent in commercial production which are approximately of the same order as those met in other industrial establishments. The problem has been solved; it remains merely to overcome the incidental difficulties.

10th. The road to success in the briquetting problem is strewn with the wrecks of ill-conceived attempts to do this apparently simple thing—failure resulting from either lack of knowledge of what had been done, lack of technical experience, or shortage of money.

11th. For the above reasons, amongst others, private capital is chary of such enterprises. It is argued that the chances of failure are great, and, as the market cannot be cornered, any process when successfully developed will be utilized without cost by competitors. The situation in Saskatchewan, therefore, should be grappled by the Government.

12th Therefore the business may be continued by the Government as a public utility, or, as demonstration having been made and results shown, private investors may confidently venture.

Equipment Recommended.

To carry out on a commercial scale the carbonizing and briquetting of lignites, a considerable amount of equipment is required, and it appears that suitable machinery is obtainable at the present time. In this connection your committee had, through Mr. Haanel, and also individually, the advantage of the advice of mechanical specialists. The following recommendations are submitted:—

1st. By establishing a plant in the Souris coal fields in the neighborhood of existing mines, the demonstration when made will have covered the treatment of the most difficult material on the American continent, and therefore, success with other and better fuel will be comparatively easy.

2nd. Having passed the laboratory stage, it becomes inadvisable to consider the establishment of a plant of less than 100 tons per day, as the problems involved are not echnical so much as commercial, covering such questions as operating temperatures, mixtures, binders, percentages of binders, wages, cost of supplies and repairs.

3rd. We have estimated upon a briquetting press with a capacity of 10 tons per hour, operated 10 hours per day, and producing 100 tons.

4th. We recommend installing one (1) carbonizing oven with a capacity of 2 tons per hour, operated 24 hours per day, total capacity say 50 tons.

5th. Also a waterproofing plant of a capacity of five tons per hour, for 24 hours, or say 100 tons total capacity.

6th. Also conveying and power plant for 100 tons capacity.

7th. Also complete buildings for covering the 100 ton plant.

8th. By the above arrangement there will be no immediate purchase of the second carbonizing oven, which will be necessary to complete the plant, until full commercial tests are made upon the one unit provided.

9th. The capital cost of the above with a production of 15,000 tons per year will be $320,000, and yet with this partial equipment all problems may be worked out on a commercial basis.

10th. For the full plant of 30,000 tons per year capacity, an additional carbonizing unit will have to be added. The capital cost of the completed plant as per table No. 1 being $370,000.

11th. The production costs at the plant for carbonized and briquetted fuel, covering operating costs and fixed charges will not exceed per ton $7.00.

12th. An inspection of the figures upon which the results are based indicate that in every case a most conservative view has been taken. The capital costs are high, labor is allowed for with liberality, percentages for depreciation, repairs, etc., are high and the costs of materials also. As a matter of fact, the estimated costs herein given are much we are aware. It can, therefore, safely be predicted that no probable combination of prices could exceed the aggregation here given.

Commercial Conditions.

Having dealt with the technical aspects of carbonizing and briquetting, it is now appropriate to discuss the handling and marketing of the finished product. This involves commercial handling which is equally important as production. As notes on the above remarks, the following are presented:

1st. The plant in contemplation will be constructed as a unit to which other units of similar size can be added, or established elsewhere. A similar plant of this size would not supply more than a local market. If constructed at Estevan for example, it would have its market in Regina, Moose Jaw, and the intervening country, as the tonnage of 30,000 per year of domestic fuel would only supply the requirements of a population of 20,000 people.

2nd. Assuming a cost of $7.00 per ton at the plant, and a transportation cost of $1.50 to Moose Jaw, with a dealer's profit and delivery cost of $1.50 the total price to the consumer at Moose Jaw would not exceed $10.00 per ton. It would be less at Regina, and still less in the intervening country districts where, it would not be sold to a dealer or delivered by him, but would be unloaded by the farmers from their own cars. This price at Moose Jaw, however, under the worst conditions would be two to five dollars less per ton than present prices paid.

3rd. While the present costs of coal have been referred to above, it must not be supposed that these will continue, for recent past records indicate an increased cost of 50 cents per ton per year. As a matter of fact, the rate of increase may be expected to be considerably higher than this, leading eventually to the elimination of anthracite altogether on the score of price, with the imminent prospect of an embrago being placed on the export of this coal from the United States in the not distant future. In short, the costs of anthracite must go up, and the costs of briquettes will go down with larger production, and the spread, therefore, becomes continually greater.

4th. Using present figures for one year's operation, the annual saving of a minimum of $2.00 per ton to the people of this district would total $60,000.

5. Even if no saving were made, and the selling costs of briquettes were as high as that of anthracite coal at present, there would be kept in the country the sum of $360,000 per year.

Procedure.

If the suggestions made be considered adequate to establish the advisability of the construction of such a plant as is indicated herein, other questions will immediately arise which should be looked at in advance.

1st. Contracts will have to be entered into for all kinds of machinery without restriction as to where it is produced or by whom it is produced, but considering only its demonstrated suitability for the work in hand.

2nd. The question of the site of the plant will have to be decided upon with a view not only to proximity of supplies, but also of alternative supplies from whatever mines are available, or, possibly, from a Government-owned mine, which should be situated as closely as possible to the site of the plant, thus providing a supply in case of trouble with other mines.

3rd. Contracts will have to be entered into with an existing mine or mines for such material as the waste fines. In this connection it may be stated that usually the mines only operate in winter when lignite is used, as it cannot be stored, whereas as briquetting plant would purchase all the year round and use what is now practically waste material.

4th. A staff will have to be appointed consisting of manager or superintendent, chemist, etc., on the basis of fitness for this particlar class of work, as the character of the work implies a certain degree of special training.

5th. Arrangements will have to be made with dealers or otherwise for the distribution of fuel in competition with coal. With a small plant such as here indicated there should be little trouble with this aspect of the case, while the product would be of sufficient volume to give a demonstration of commercial costs.

6th. An office system will have to be installed by means of which accurate costs of raw materials entering into the product, the labour costs and the tonnage output costs may be found, and the whole lead up to something that might be presented to the Government in a general report covering results.

7th. A review of the above activities does not indicate that they are such as could best be carried out under Departmental control. The whole project is a commercial one, which will have no justification for its existence if it does not give commercial results, and this involves commercial handling. It is imperative therefore, that the construction and operation of this plant be placed in the hands of a Board constituted of technical and business men whose hands are not tied in any way.

In view of the discursive nature of this report a summing up may be advisable.

1st. The necessity exists for the development of all our fuel resources.

2nd. The best immediate returns will be secured by the development of lignite briquetting processes.

3rd. The country has the raw materials, the brains and the command of money for such national work.

4th. Leaving the problem in private hands will result in long delays during which we must buy our fuel abroad.

5th. In view of the broad national importance of the field the actual capital necessary is of secondary importance only.

6th. Full success will mean the stoppage of millions of outgo to the United States and its expenditure in wages in Canada.

7th. If only a partial success be secured a step shall have been taken in a problem which must be solved ultimately.

8th. A complete failure is unthinkable, but granted that outcome, the money if judiciously spent will have demonstrated the uselessness of further trials, and will lay a ghost which otherwise will be continually in evidence.

Action.

If this report be found convincing and be adopted by the Council prompt action will be necessary as the season is advancing.

It is estimated that a year will be required to construct and equip the plant, owing to existing conditions in Canada and the United States.

Further, a period of six months may elapse before the plant in operation will have so adusted its processes as to turn out a uniform product at a commercial cost.

In order, therefore, that the plant should be in operation by this time next year and delivering its output by the winter of 1919, the buildings must be erected during the coming summer or within a period of six months. During the ensuing winter the machinery may be installed.

Why Did This Floor Fail?

AN unusual failure in a concrete floor slab is discussed by B. H. Wait, Dist. Eng., of the Portland Cement Association:

A floor recently laid in a bakery did not get hard. The aggregates were those successfully used in other work and the cement of a standard brand. Both were subsequently tested and found satisfactory. A second trial in the bakery gave similar results. The work was done by experienced workmen.

I have had an opportunity to inspect the job in question and find there was intense heat persent in the bakery, and as the sand and stone used were excellent, the failure was without doubt due to the drying out of the mortar too quickly, or to the fact that the cement had been stored close by the furnace for some time. When mixed, the materials, having been stored inside and being hot, the cement evidently flashed, with the resultant failure. This happened the second time with a new batch of cement stored under the same conditions. After the second failure, the work was replaced with mortar mixed outside the bakery, and the work was successful. The patches last placed are in excellent condition.

There may be the possibility that the concrete in the first place was not properly wetted down and cured before placing, but it would be well to note the danger of using material in the aggregate that has been subjected to, and mixed in, an excessive heat.

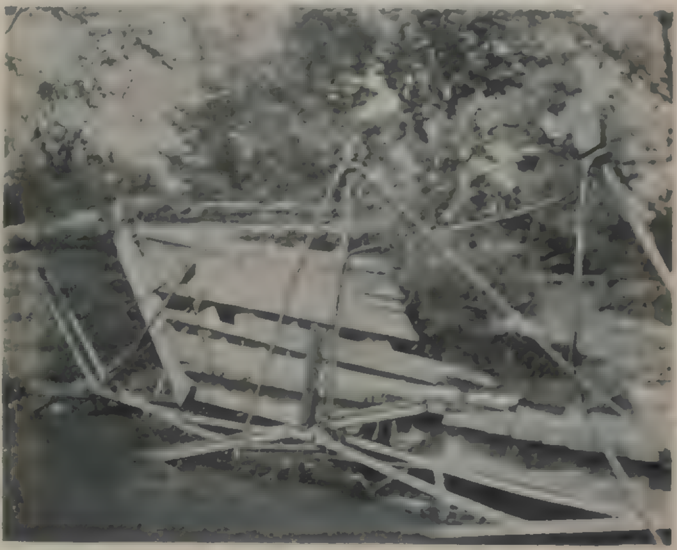
Why Do Some Bridges Stand Up?

By E. H. Darling, M.E.

THERE are many small bridges in existence to-day, in Ontario, having iron trusses in which old railway T-rails are used in one way or another as truss members or floor beams. That they are "shakey" is evident to even a non-technical observer, while to an experienced engineer they appear absolutely impossible. Yet if any one should suggest to the township fathers who are responsible for them, that they are in any way dangerous he will usually be met with what is considered an unanswerable argument, that a bridge which has carried the traffic for thirty, forty, fifty years or more and is apparently as sound as ever must be considered quite "good enough". The following story is the answer.

The accompanying photograph shows one of these ancient bridges, of fifty feet span, which recently met disaster. It is said to have been erected at this site thirty years ago and that before this it had seen service for fifteen years at another site. Surely it was well tested out and besides, a new floor had been put on it only a short time ago. And yet it collapsed under a load of six team of horses standing quietly upon it,—a load which was equivalent to twenty pounds per square foot of floor area. The horses escaped with little injury but two men were hurt, one rather seriously. Investigation brings out the astonishing fact that, while the immediate cause of the failure was probably a local defect in material, this light load of twenty pounds per square foot exceeded what could be considered the safe capacity of the bridge.

The line drawing herewith shows the dimensions of the bridge and its members and, taken with the photograph, will give a good idea of the construction. The bottom chord is composed of eye- bars with pin connections. The top chord and end posts are single sixty pounds per yard railway T-rails which are set loosely in cast iron blocks at the panel points. The ends of the rails are rough and no attempt is made to secure an even bearing. The floorbeam is simply a trussed rail. The knee braces of round rods are worthless while the absence of end struts and shoe anchors renders the lateral bracing useless even if the light ring which forms their center connection were of any value to transmit tension. Eccentric connections and other defects in design may be noted. The floor, as stated above, was practically new but if the iron work had been painted since it was first erected it did not show it.

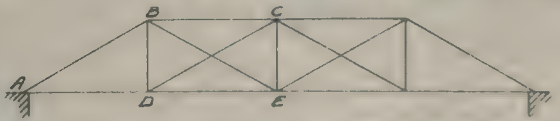


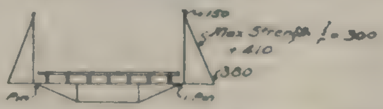
A bridge of ancient design, 50 ft. span, collapsed under load o 20 lbs. per sq. ft.

Estimated stresses under various conditions are given in the accompanying table.

(1) Safe working stresses for each member according to standard practice.

Table of Estimated Stresses under Various Conditions





	Assumed Loading	Member								
		AB	BC	ADE	BE	CD	BD	CE	Floor Joist	Floor Beam
1	Safe value of Members according to Standard Specifications Material – Good Iron.	0 $\frac{l}{r}$ = 228.	0 $\frac{l}{r}$ = 199.	-34,000 (@1200#)	-5,000	-5,000	-24,000	+0 $\frac{l}{r}$ = 200 8 300	For Oak 1600 lbs per sq in	Strength of Floor Beams is limited by the strength of pins in tie rods. They are safe for a Uniform Live Load of 24 lbs per sq ft, or a 3 Ton Engine
2	Est. max. Safe Working strength, assuming sound material and perfect alignment.	+16,000	+20,000	-67,500	-6,300	-6,300	-26,200	+8,000	Max unit stress 3,000#	
3	Dead Load Stresses (Stresses due to weight of Bridge)	+8,300	+9,600	-7,000	-2,800	0	-2,300	+400	140	
4	Maximum stresses at time of failure. 20 lbs. per sq. ft. no impact. Perfect alignment.	+13,600	+15,800	-11,850	-5,450	-900	-4,050	+850	330	
5	Maximum stresses for Standard Class B 10-Ton Engine Assuming some dead load.	+34,500	+36,100	-28,300	-18,100	-6,600	-11,950	+3,600	3,500	
6	Maximum stresses for Uniform Load Class B 80 lbs. per sq ft (10% impact)	+29,500	+34,400	-25,800	-13,400	-3,600	-9,300	+2,200	1,020	

(2) Estimated strength of members at yield point or half the ultimate strength.

(3) Estimated dead load stresses.

(4) Estimated stresses at the time of failure.

(5 and 6) The stresses which should have been provided for in country highway bridges of this class the assumed loading being Class B, Ontario Government specifications. For sake of comparison the dead load is assumed to be unchanged whereas in a correctly designed bridge it would be somewhat greater.

From the evidence of eye witnesses, which investigation bears out, it was apparently one of the end posts that failed first, bending outward and breaking in two in the middle it let the whole span collapse like a pile of blocks. The fracture of the rail showed indications of an old crack and in addition to this the metal was coarsely crystalized. Other pieces which were broken in subsequent handling showed the same condition of metal. This end post had a ratio of length to least radius of gyration of 228 and its estimated strength, using Euler's formula, is 32,000 pounds. The static load, at the time of collapse is estimated at 13,600 pounds but a slight defect in material or an eccentricity of a quarter of an inch would easily account for the failure. The knee brace which was depended on to hold the top chord in line has a ratio of 1/r of 300 and was of no practical value.

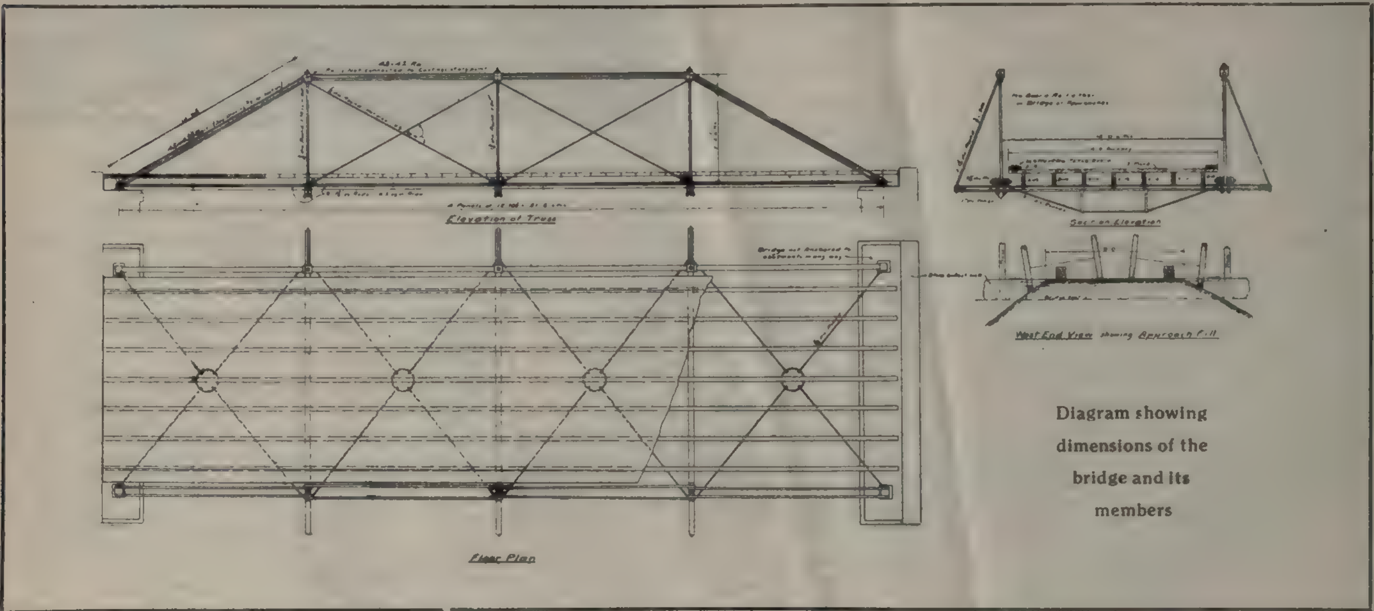


Diagram showing dimensions of the bridge and its members

On the whole however the designer of this bridge was not altogether ignorant of the general principles of truss stresses. He made ample provision for tensile stresses and used lower unit stresses for compression members. But in his day the strength of compression members and the danger of eccentricity were not well understood and the importance of well designed details was not appreciated.

But in spite of its defects and weakness this bridge gave satisfactory service for forty-five years! The inference is that in all that time it was never called upon to carry a load of more than a few tons. And yet in the most isolated districts heavier loads are quite probable. The writer has collected some reliable data as to the weight of a herd of cattle and finds that a loose drove in motion may weigh over seventy pounds per square foot while when crowding together, as it is the nature of cattle to do when crossing a bridge, the weight will exceed ninety pounds per square foot. Any bridge which cannot safely carry this load should not be allowed on a public highway no matter how satisfactory it may otherwise be, and if they are, as in this case, a real danger to life and property they are by no means "good enough."

The sequel of the story is worth recording. The township fathers who were responsible for this bridge entered suit for damages against the owner of the teams which caused the collapse. **They then had the old bridge repaired and set back in place.** But it seemed to have acquired a bad habit in its old age for in a few weeks it collapsed again—this time under a load of ice. This seems to have been taken as a sign and an indication that perhaps after all this structure had outlived its usefulness so they settled the suit out of Court and built a new bridge, having wasted in law costs, damage claims, and repairs to the old bridge more than half the cost of the new structure.

The newspaper men of Eastern Ontario recently met with the officials of the good roads association newly-formed in that part of the province, to arrange a campaign for highway improvement. The meeting was held in Carleton Place. Alderman Findlay of Ottawa was in the chair, and Mr. Baker, secretary of the Automobile Associations of New York state, was present and addressed the meeting. As a result of the conference, a motion was introduced by Mr. J. C. Knox of Smith's Falls, seconded by W. W. Walker, of Perth, and carried: "That this meeting of newspaper editors of Eastern Ontario assure the Good Roads Association of Eastern Ontario that they heartily endorse the movement for securing a fair share of government expenditure for public highways and the good roads movement in general, and offer to support the movement with their newspapers, also that we suggest to the executive the employment of a publicity secretary." Messrs. McKim, Smallfield and Laurin were chosen as the three pressmen to be on the board of directors of the association.

Cost Keeping System for County Highway Work

By H. A. Sewell[*]

THE number and character of forms to be used in a cost keeping system for county highway work will depend largely on the size of the county and the method of handling the superintendence of road work; but there are certain elements or principles of any such system which will apply to all cases. These elements I will group under the heads (1) Authorization of Work, (2) Reports, (3) Segregation, and (4) Summary.

Budget of Expense.

The first element under authorization of work should be a well-considered budget of expense, based not upon the usual basis of "salaries or per diem", "contracts," "labor," "team work," "material and supplies," "tools and Machinery," etc., as we generally find in the county budget; but rather upon the amounts to be allowed for all these items for construction or maintenance of each particular piece of road, or bridge, whether it be by contract or day labor, and, in addition, a fixed amount for overhead for the district or county, as the case may be, which cannot properly be charged to any particular stretch or road. No one realizes more than do I the difficulties of forming a budget under our present system of county bookkeeping but after installing the rest of a cost keeping system it will yearly become an easier matter to formulate an adequate and well-balanced budget. After the adoption of the budget it should be rigidly adhered to, except in cases of palpable oversight or emergency.

Authorization Blanks and Work Orders.

Having adopted the budget, the next element of authorization is some form of "authorization blank," "work order" or "job sheet," to be delivered to each man in charge of road work, for each individual job, by his superior in charge of district or county, as the case may be. This blank should show in more or less detail the work to be done and the amount to be allowed for the work.

Closely allied with the "work order" is the "requisition." Agreeable to local conditions, it may be issued to the job foreman by his superior, or by the foreman himself upon the authority contained in the work ordered. The principal object of the requisition is to present haphazard and unregulated purchase of material and machinery. Needless to say, neither the "work order" nor the requisition applies to contract work, as the contract and specifications are sufficient authorization of the work and the bond protects the county.

Segregation of Expenditures.

The second group of elements I have classed as reports. By this I mean the segregation of the expenditures of road money so as to show on what particlar piece of road the expenditure occurred, and, further than that, if possible, the exact location and nature of the expenditure. The forms to be used for these reports, and whether they shall be daily, weekly or monthly, will again depend upon the magnitude of the work and local methods of handling the same. Another important factor in designing a report is the character, education and experience of the person making the report; and great care must be exercised in not making it so complex as to cause either of the alternatives, no reports, or the loss of a good road boss.

The ideal place for the report would be on the claim vouchers or pay roll, as such a system would be simple and direct. Unfortunately, however, the vouchers and pay rolls used in this state are prescribed by bookkeepers and not by engineers, and no provision is made for segregation of time. Therefore the next best scheme is to design a system of report which may be properly segregated and distributed.

The report or reports should show the work order number of the job, the names of the foremen and workmen, the location and exact nature of the work, and the number of hours working time.

In case the foreman is allowed to requisition materials or tools for his use or take some from stock, he should be required to render a memorandum report of such transactions. On contract work the inspector should make the reports. Traffic reports should be kept on all maintenance work where possible.

Distribution of Costs.

There is a large group of elements to be considered under the head of segregation and distribtuion, as there are so many heads under which costs might be segregated. Here, however, we must follow our budget and distribute costs as nearly as possible according to the items outlined in the budget, leaving any other segregation, desired as a sub-segregation under the main segregation, according to overhead and roads, to be recapitulated in the summary of costs. The reports having been made as simple as possible to be and still convey the necessary information, most of the work of segregation must be done in the office, and it may be carried as far as the accuracy of the data and the local conditions render advisable.

The first question to be decided is which items are to be considered as overhead expense and which are to be charged as road expense. It is my rule to charge every expense to overhead which cannot be directly traced to some particular road or group of roads, but is of general value to the district or county and may be (although not necessarily must be) of general use. Thus, small tools may be bought for and worn out by a patrol crew on a particular section of road, yet such tools are of general value and might be used elsewhere should occasion require, and would be charged to overhead expense, heading "Tools and Machinery." The headings and subheadings should cover the principal items of overhead and the remaining overhead items should be carried in miscellaneous columns, adjoined by a blank column to show cause of outlay. Sometimes one claim paid will be segregated under several heads in several columns. "Materials and supplies" purchased in quantity, which will utimately be charged direct to the several roads, should be carried in a stock acount and, when used, should be charged to the respective roads and the amount credited to the stock account. The extent to which these accounts need be subheaded will depend largely on the magnitude of the work accounted.

The items of road expense chargeable to the several roads direct are easily classified into labor and materials, and the subheads are familiar to all. Here, for convenience, the entire crews' time for a certain period of time, depending on the report interval, may be entered together as segregated by the reports, checked against the pay rolls. If possible, different classes of work readily measured by units should be segregated and the unit cost entered, as well as the entire cost of the class of work and of the whole section. For contracts the bid prices and actual costs may both be entered if desired. Engineering and inspection on any particular road should be carried in an engineering account and charged to that road or job in the yearly summary. Bridge work may well be carried in separate acounts in a bridge ledger and charged to the road on the yearly summary.

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[*] From a paper before Washington Association of County Engineers.

Annual Cost Summary.

Having segregated the various items for future reference, the next question is how to make use of them. This is through the summary, preferably annual. In the annual report or summary the divisions of the budget should be closely followed, so as to show whether expenses overrun or fall short of the budget. This is for the information of the general public. In addition to this a recapitulation should be prepared, if possible, for the benefit of highway engineers, showing unit costs of construction and maintenance, based upon convenient units. On maintenance the most convenient unit is probably the mile; and by use of the traffic reports a convenient unit is cost per year per mile per unit of traffic.

The report should, if possible, contain a statement of assets in the way of machinery and tools, based upon their depreciated value at that time, and the difference between this statement and the one for the year before should be subtracted from or added to the tools and machinery acount under overhead expense, according as the asset value has increased or decreased. Where a piece of machinery is finally junked and its asset value gone, its entire cost should have been absorbed by the overhead account.

The system which I have installed in my own county is based on that provision of the law which provided that the county engineer shall keep a record of the history of each road.

The authorization blanks consist of work orders and requisitions issued by the supervisor to his respective foremen and by the engineer for permanent highway maintenance. These blanks are printed in triplicate, the stub being retained by the supervisor the next division going to the engineer's office, and the outside blank going to the foreman. In the case of a work order he keeps it, while a requisition is turned in to the person or firm providing the material or machinery, to be attached to claim vouchers. The engineer files his for future reference. Certified copies of all contracts, of course, are filed in the engineer's office, as required by law. In some cases small jobs of day work on construction or maintenance are let out to local parties on work orders. In such cases the work order numbers and classification of labor on the pay roll are usually sufficient to properly record the work, so it is not customary to require reports on such work.

All foremen employed on more than one job are required to turn in monthly industrial labor reports showing when, where and how all work is done. While at first sight the idea of having a separate sheet for each individual may appear cumbersome, it is simple for the foreman, and affords the exact information desired. It also is easily checked against the pay roll, and in a small county, at least, is easily handled in the engineer's office by placing in a letter file for each month and segregating the various reports for entry in the ledger.

A memorandum of all tool and machinery purchases and transfers is also required of all foremen on a "Tool and Machinery" report and all materials and supplies bought, or taken from stock, must be accounted for on "Material and Supplies" report. On jobs of magnitude a weekly report is required to keep a check on the work. On these jobs the foreman is usually competent to segregate work, or there is an inspector or engineer on the job; therefore a segregated report is required, thus saving an office segregation. We require a daily report from truck crews, not because of the fact that the magnitude of the work requires it, but because on report blank could be formulated which would show the elements required for a larger period than one day without being too complex to be kept in the field. We have the patrol system of maintenance on our main highways, and patrolmen are required to keep traffic reports for certain weeks.

A blank for the use of the supervisor is the Tool and Machinery Receipt, and, while not properly speaking a part of the cost keeping system, a word of explanation may be proper on account of the close connection a check on tools has with the cost keeping. The receipt proper is the stub, and is kept by the Supervisor after being signed by the foreman. Upon returning the tools, or otherwise accounting for them, the foreman receives his release in the return receipt. In case tools are to be reloaned the supervisor gives the man to receive the tools a reloan order in lieu of the tools, which he presents to the man possessing the tools as his authority.

The Books Employed.

The record books employed in the county consist of Overhead Account, containing the overhead expense and stock account; a Road Ledger, in which are charged road expenditures proper; a Bridge Record, for bridge expenditure, and Engineering Account.

The Overhead Account is a bound book, with columns to show the following items; Date, Name, Warrant, Requisition No., Cause of Outlay, Tools and Machinery (subheads, No. Units, Unit Price, New Equipment, Maintenance Old), Supervision, Insurance, Miscellaneous.

The Stock Account should really be a separate book, but we keep it in the same book as overhead to save space. It comprises four columns, besides the date, name of claimant and voucher number, namely: Material or Supply, No. Units, Unit Cost and Total Cost. If it were carried in a separate book it would be more convenient to head groups of three columns with the kinds of material and supplies and place the other items as subheads. Whenever anything is taken from stock and charged to a particular road it is credited in red ink in the Stock Account. A column is also provided on the overhead page for items allowed but unaccounted by the reports or otherwise, which we hope in time will disappear.

The Road Ledger is divided into sheets for construction and maintenance, which are arranged together for each road and placed alphabetically in the book, acording to the road name. The sheets are very similar and are divided the same, except that the top of the sheet is different. The top of the construction sheet shows Character of Country, History of Road, Bridges, and Right of Way, or Damages. The top of the maintenance sheet shows Brief History of Maintenance, History of Traffic. The columns and headings are as follows: Year, Month, Section, Township, Range, Nature of Work, Width (Subgrade, Surface), Wages Per Hour (Man, Team, Foreman), Work (No. Units, Unit), Cost (Unit, Total), Material and Supplies, Powder, Caps, Fuse, Lumber, Steel, Cement Pipe, and Blanks, all subheaded Amt., Price, Total and Grand Total, Fund, and Remarks.

The Bridge Record, besides giving a description of bridge, shows construction on the left of the page and maintenance on the right, and is divided into Construction, Date, Name of Builder, Cost, Condition, Date, Nature of Repairs, Date, Cost, Repaired by, Remarks.

The Engineering Account shows the following items: Date, Name, Warrant No., Fund, and several blank columns to be headed with road name, and a Total Column.

Economy in the Design of Concrete Buildings

By C. W. Mayers[*]

UPON the designing engineer of concrete buildings rests the big responsibility of conservation of building materials. The mere fact that concrete is composed of cement, sand and stone, of which there seems to be an excellent supply, does not in any way relieve the designer of concrete construction of the obligation of careful study of the work in hand in order that no excess of material be used. Most errors made in concrete design are not easily recognized even by experienced estimators of building construction. For instance, hidden away inside a column there may be reinforcing steel which should be elsewhere doing work at less expense to its owner, as would have been the case had the designing engineer given proper thought to the design of this column. A large percentage of the floor space occupied by columns might be storage space for the same reason. The beams may contain an excess of steel reinforcement simply because it was less trouble to call for straight top rods to take care of negative bending than it was to determine where and how bends could have been made in order to have used the least amount of reinforcement in the design. Flat slabs may have a number of individual rods over the top of each column head, where a few more bottom rods should have been bent up to take care of this negative bending. And yet this entire building may have been designed in accordance with the recognized standards of concrete design. These errors are not errors in computations, but are errors of careless design and the result is dire waste of material.

Economy in Design Often Overlooked.

In most cities building plans are O. K'd by responsible engineers authorized by the city to pass upon these plans before the work is allowed to proceed. Errors in computation are usually detected in this process, but who ever heard of one of these authorized engineers returning a set of plans with suggestions for a more economical design? The design either "gets by" or comes back for correction on account of errors in computation, etc.

Hence, if the designing engineer does not study economy in the design of his work, he may be reasonably sure it will get very little such study from anyone. Designs prepared without this special study are sure to show a waste of building material, and the building is no better, and serves no better purpose, because of this extra expense.

Recognized standards are observed by most designers of concrete buildings as regards stresses and strains, factors of safety, etc., but unfortunately no rules, tables or data are at hand which will solve the problem of maximum economy in the choice of the various methods of concrete construction which may be used. Each building presents new problems. It is a case of careful study in an intelligent way and the designer must do this work well if he would "do his bit" and at the same time keep or build up his reputation.

Is there any position more humiliating to the designing engineer of a contemplated structure than to have a bidder who is estimating the cost of this work submit to the prospective owners a more economical design based on the same fiber stresses as were used in the original layout? This is not an uncommon event and uncomfortable complications always arise.

Insufficient Attention to Costs.

A general survey of conditions and inspection of the possible methods of construction usually constitute the first thought given to a new problem of structural design. By this inspection a process of elimination is set up and finally the engineer considers only a few schemes which could be well employed to give the owner a structure suitable for his purposes. The next step usually consists of viewing the several schemes from every angle in order to study their individual merits. Each layout possesses different advantages, some of more value than others, but each one would answer the purpose very well. For instance, a beam and girder type of floor construction may offer advantages in the way of hanging shafting if the building is to be used for certain types of manufacturing. Column spacing would perhaps work out to better advantage in one scheme than in another. Thus the discussion continues with here and there a remark about the probable cost of this and that. A decision is usually made in favor of the scheme offering the most advantages even though they are trivial. The plans are drawn up on this basis and the work proceeds. The detailed design is finished with about the same attention to costs as have been gven to the selection of the type of construction used. Generally, the owner of the completed building is satisfied, being ignorant of the fact that he could have had just as good a building for less money.

The average concrete designer makes no claim to being an estimator. In fact, he does not think it is necessary to be an estimator even of the materials with which he works. It is a fact that a large majority of men employed in the design of concrete buildings have hardly any idea of the cost of the work they are laying out, and what is more, they do not know how to find this out for themselves. Surely, if an engineer designed a structural steel girder he could tell with reasonable accuracy what it would cost by computing the weight and getting the market price of the structural steel and the labor cost of erection. Estimating the cost of concrete work is a little more complex, but each step is very similar and the process is the same.

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[*] Before American Concrete Institute.

Designer Should Calculate Costs.

A designer of concrete structures should think continually of costs, but in order to think intelligently of the cost of his work he must know how to calculate approximately the cost of his design. In no other way is he able to determine which one of his studies will serve his purpose at the least expense.

It should be borne in mind that in making designs for comparative costs, it is not necessary to work to as great a degree of accuracy as for the finished plans. Rough designs, accompanied by rough sketches, will furnish enough information for his study. In case the comparative costs of two schemes should work out the same, a more careful design might become necessary. A little practice on the part of the designer will soon reveal to him to what degree of accuracy he must work in order to get satisfactory results.

The process of estimating these various designs for comparative cost purposes is not nearly as difficult as may be supposed. Concrete is measured by the cubic foot or cubic yard, forms by the surface measurement in square feet and reinforcement by the pound or ton. After the quantities have been calculated for the various designs, unit prices are fixed and the total cost of the member estimated. It is usually here that the engineer throws up his hands. In fact, it is very likely that he knows but little about the prices of this class of material and labor, and in his rush of work he has not kept in touch with the fluctuations, and feels he does not have time to inform himself properly on this subject. Again, it should be understood that it is not necessary to fix absolutely accurate unit costs to these quantities in order to obtain reasonably accurate cost comparisons. As long as the same unit costs are used for similar types of work in the various designs, the comparative costs will be surprisingly accurate. In fact, some of the unit costs may be in error 25 per cent or 30 per cent., and yet the resulting costs will show unquestionably which type of construction should be used. For example, the quantities for two designs (a) and (b) for an interior column are given here and these quantities are priced for current normal conditions, under "Estimate A," and another estimate for the same quantities with the unit prices grossly in error is shown in "Estimate B."

Estimate A.

(Scheme a.)

Conc. (1 : 1½ : 3), 52 cu. ft. at 36½c	$18.98
Forms, rd. steel	15.00
Reinfct. (vert.), 514 lb. at 5c	25.70
Spirals, 264 lb. at 5½c	14.52
Lost fl. space, 7/10 sq. ft. at $2.75	1.92
Total	$76.12

Scheme b.)

Conc. (1 : 1 : 2), 52 cu. ft. at 43c	$22.36
Forms, rd. steel	15.00
Reinfct., 245 lb. at 5c	12.25
Spirals, 264 lb. at 5½c	14.52
Lost fl. space, 7/10 sq. ft. at $2.75	1.92
Total	$66.05

Estimate B.

(Scheme a.)

Conc. (1 : 1½ : 3), 52 cu. ft. at 27c	$14.04
Forms, rd. steel	19.00
Reinfct. 514 lb. at 3¾c	19.28
Spirals, 264 lb. at 4c	10.56
Lost fl. space, 7/10 sq. ft. at $3.50	2.45
Total	$65.33

Scheme b.)

Conc. (1 : 1 : 2), 52 cu. ft. at 32c	$16.64
Forms, rd. steel	19.00
Reinfct., 245 lb. at 3¾c	9.19
Spirals, 264 lb. at 4c	10.56
Lost fl. space, 7/10 sq. ft. at $3.50	2.45
Total	$57.84

It will be seen that although the comparative total costs of the schemes (a) and (b) are entirely different in the two estimates, the resulting comparative costs in both "Estimate A" and "Estimate B" show conclusively the design (b) is the cheaper column to build. It will also be noticed that the percentage of cost saved by using design (b) is about the same in both estimates. However, the alert engineer will soon become as interested in having his unit costs in accordance with current prices of material and labor as he is in having his design correct.

Design Calling for Least Material Not Always Cheapest.

Contrary to the opinion of most engineers, the concrete building design calling for the least amount of material is not always the cheapest building to erect, as such a building may call for much more labor. Form work is a big factor in the cost of concrete buildings, and this phase of the operation must be given careful consideration in order to simplify the construction of the form work as much as possible. Study must be made also to determine whether the complexity of forms in a comparatively light design would not make the final cost of the building in excess of a building designed of simpler yet heavier construction. Concrete floors designed on the flat slab method sometimes have considerably more material in them and yet work out cheaper than a beam and girder type designed for the same conditions. Placing reinforcement costs more per ton and forms more per square foot in a beam and girder construction than the same operations in a flat slab construction. In laying out floors of the beam and girder type, the addition or omission of one beam per bay may influence the cost of the design a great deal. Changes in column spacings will also have the same effect. It is only by making the design of a typical floor bay of the various schemes considered and getting the quantities and costs of these schemes that it will be possible to tell definitely which method should be used. Many times concrete columns should be composed of a richer mix of concrete and have less reinforcement. In a building of several stories it is necessary to devote considerable study to the design of columns in order to locate the point where the mixes should change, where spirally reinforced columns should be introduced, and also to consider carefully the loss or gain of floor space occupied by columns. It will be necessary to make several sketch designs and calculate the cost of each. Thousands of dollars may be wasted by improper column design and still the error is one which would not readily attract attention. There is a certain type of design for every part of the construction which will show maximum economy and it is up to the designing engineer to calculate the costs of his various designs and determine for himself which one should be used.

Obtaining Unit Prices.

Up to this point this article has emphasized, principally, the necessity of making several preliminary designs of the various members of a concrete building and calculating the cost of each design before the final layout is begun. Not much light has been shed upon the method of obtaining unit prices to fix to the quantities of material and labor. Unit prices are subject to wide fluctuations. Markets, labor, location of the work in question, speed of the operations, etc., and many other items enter into the making of these costs. However, as stated before, these unit prices need not of necessity be extremely accurate, and the designing engineer need not feel that he cannot price closely enough to obtain fairly accurate results.

A list of approximate unit prices have been tabulated here which may be used to calculate the comparative costs of the principal members in a concrete building. Judicious use of these unit costs will enable the designer to incorporate in his design the most economical methods and at the same time develop a keener eye for economical construction.

Concrete	per cu. yd. (1 : 2 : 4 mix).		
	Cement, 1 2/3 bbls. at $2 per bbl. at the job		$3.33
	Sand, ½ cu. yd. at $1.50 per cu. yd. at the job		.75
	Crushed stone, 1 3/10 tons at $2 per ton at the job		2.60
	Plant, cost		**per cu. yd.**
	Freight charges	**$0.05**	
	Rental of mixer, etc.	**.35**	
	Purchases	**.45**	
	Labor	**.40**	
			1.25
	Labor of mixing and placing		**1.25**
	Total cost per cu. yd		**$9.18**
	Total cost per cu. ft.		**.34**

Concrete mixed in the proportion of 1 : 1½ : 3 will require about one-third of a barrel more cement per cubic yard. This will add about 67 cents to the cost of one yard of concrete in place, making the unit price about $9.85 per cubic yard, or 36½ cents per cubic foot. If a 1 : 1 : 2 mix of concrete is used, the cement will be increased about 1-2/10 bbl. over and above that used in a 1 : 2 : 4 mix. At $2 per bbl. this would make the cost of 1 : 1 : 2 mix concrete about $11.58 per cu. yd., or 43 cents per cu. ft. In large plain concrete footings it is sometimes advisable to use a concrete mixed in the proportion of 1 : 2½ : 5. Concrete mixed in this proportion requires about 3/10 of a barrel less cement than 1 : 2 : 4 mix. Figuring cement at $2 per bbl., concrete mixed in the proportion of 1 : 2½ : 5 works out at approximately 32 cents per cu. ft. in place.

"Plant" the Most Uncertain Item.

In making estimates for the cost of concrete in place, the most uncertain element entering into this cost is the item of "plant." The cost of "plant and tools" varies greatly with different building superintendents and depends largely upon the foresight of the persons responsible for the layout of the job operations. The number and location of the mixers, towers and runs used on the job, layout and extent of storage space for aggregate, source and expense of power, etc., distance over which concrete machinery has to be transported, good or bad mechanical conditions of rented machinery, rental rates of machinery, replacement of missing shovels and other tools and many other variable expenses go to make up this cost. The size and shape of the building, as well as the speed of the operations, play an important part in this cost. The "plant" cost for a job containing 6,000 cu. yd. of concrete need not necessarily be one fifth more than a job containing 5,000 cu. yard. of concrete. The "plant" will, of course, cost more for the job containing 6,000 cu. yd. of concrete but since the cost of erecting and dismantling the "plant" work for both jobs may be the same, the extra cost of "plant" for the larger job will be principally extra depreciation or rental, fuel, power, wear and tear and loss of tools. However, "plant" expense enters into all concrete costs and must be included in the unit price of concrete if we would get a reasonably accurate idea of the ultimate cost of the work. At the present high cost of all building materials and labor, "plant" costs cannot be safely assumed to be less than $1 per cu. yd. and will very seldom run as high as $2 per cu. yd. of concrete. Owing to this wide variation in the cost of "plant," it is necessary in estimating concrete to strike an average cost which, while not accurate, **will cover the usual "plant" work, and give a unit** cost for concrete in which all items of material and labor have been considered. It is with this in view that **a "plant" cost of $1.25 per cu. yd. has been used in** making up the unit cost of concrete in place as given **in the above tabulation.**

Amount of Aggregate Considered Equal for Various Mixes.

In calculating the amount of materials necessary to make 1 cu. yd. of concrete, it will be noticed that the only change made in the quantities for the various mixes has been in the amount of cement used. It has been assumed that a cu. yd. of 1 : 1 : 2 concrete will require the same quantity of sand and crushed stone as a cu. yd. of 1 : 2 : 4 concrete. Theoretically this is not true, but in general practice there is some waste of material and it has been found that the small differences of aggregate used in the various mixes of concrete in a building are negligible. A very large part of the concrete in a building is a 1 : 2 : 4 concrete, therefore, the aggregate quantities of 1 : 2 : 4 mix are generally used for all concrete work and the cement alone is changed for various mixes. It will also be noted that the quantity of cement, sand and stone used here is somewhat in excess of the amount usually given in the tables published in various text-books. It must be borne in mind that the waste of materials on the job must be absorbed and the quantities in tables compiled by laboratory tests must be somewhat increased. It is actually necessary to estimate on about 1 2-3 bbl. of cement to make 1 cu. yd. of 1 : 2 : 4 concrete on a job where the usual construction methods are employed and in other mixes of concrete the cement should be proportionately increased.

The prices of concrete work as tabulated here are about 30 per cent in excess of pre-war prices and 50 per cent more than the prices of 1913. These costs based on the present high cost of material and labor should be adjusted from time to time as necessary.

The cost of steel reinforcement is extremely erratic in its fluctuation, but at present it may be assumed at $90 per ton exclusive of the labor of bending and **placing. It will cost from $6 to $15 per ton to cut, bend and place this reinforcement, $100 per ton, or 5**

cents per lb., being a unit price which may be used to give reasonably close cost ratios. Reinforcement requiring much bending and made up of small bars should be figured about ½ cent per lb. higher than steel requiring only a small amount of bending. Spiral reinforcement for columns should be figured at an extra cost of about ½ cent per lb. over and above plain bars. In estimating the weight of spiral reinforcement it should be remembered that about 7 per cent should be added to the weight of the spirals for welding laps.

Form Costs.

Forms for round columns are usually made from sheet metal and in flat slab construction it usually works out cheaper to use round interior columns formed with this material. However, the cost of forming an interior column 26 in. in diameter for flat slab construction is about the same as forming a column 20 in. in diameter designed for the same purpose. This being the case, it is not necessary to consider the difference in the cost of forms due to different diameters of round interior columns. It may be well to remember that it costs somewhat less to build an interior column having a head by using a steel form than it does to form the column of wood, as the cost of forming the head in wood is no small part of the column cost. The list of unit prices given here covers the cost of labor and material for form work for the principal operations in a concrete building, but are tabulated for use in making comparative estimates only. It must be borne in mind that these unit prices are for the use of the engineer in weeding out the more expensive designs and are not to be used for making actual estimates of buildings without regard to conditions and what not. While these costs might be more or less useful in arriving at the total cost of a concrete building it should be remembered that they are only approximate units to be used for the purpose outlined herein.

Type of Construction.	Sq. Ft. Cost. (Surface Measurement.)
Forms for flat slabs, including drop panels	$0.09
Slab, beam and girder construction, slabs to span not less than 9 ft.	.12
Slab, beam and girder construction, slabs to span not less than 7 ft.	.13
Slab, beam and girder construction, slabs to span not less than 5 ft.	.14
Column forms	.15
Floor beams and girders, not including slabs	.16
Wall beams	.14
Partitions and wall forms	.15
Footing and foundation forms	.15
Round steel column forms, including heads, each	15.00

Now that the methods of arriving at the comparative costs of the various types of concrete construction have been outlined, it is believed the designer will be able to work more intelligently regarding the cost his work involves. Typical dimensioned sketch cross-sections of the building from the roof slab to the footings should be made and the work of estimating done from these sketches. In this way the extra column lengths required to obtain the same clear story heights will enter into the estimate. This is quite a factor in comparing flat slab with beam and girder designs. Estimates made from these cross-sections for a length of building equal to one bay only, is the usual practice. In this way the cost per lineal foot of building as well as the cost per square foot of floor space may be calculated. Comparisons of costs made in this manner are genuine proofs to the designer that he is giving the design proper study for economy, and will result in a conservation of building materials, save good dollars for the owner, and establish for the engineer the reputation of being a designer of economical concrete buildings.

Doubling Elevator Capacity

CONSTRUCTION work, now in progress on the addition to the Northwestern Elevator at Fort William, Ont., will, when completed, double the capacity of this plant. The contractors expect to have the work completed by the first of October so that the fall crop may be handled.

The illustration shown here is a photograph of the existing plant which has a capacity of 500,000 bushels, the construction throughout being reinforced concrete.

The new addition is reinforced concrete and the equipment is of the most complete and modern type.

Being increased to million bushel capacity.

The present elevator is a very rapid grain handling plant. It has an unloading capacity of 100 cars in 10 hours and the cleaning and separating capacity has been designed to balance the plant. The general equipment of the existing elevator is as follows: Two 12,000 bushel receiving elevator legs; one 16,000 bushel shipping elevator leg; four 2,000 bushel cleaned wheat elevator legs; one 2,000 bushel screenings elevator leg; four number nine Monitor separators; one number six screenings separator; two 1,600 bushel Fairbanks type scales; one number eight Northwestern wheat and oat separator; two 2,000 bushel garners; four 1,500 bushel unloading hoppers.

The equipment for the new addition will be substantially a duplicate of the existing plant. A reinforced concrete substation is also under construction to handle power for the elevator. This is being equipped by the Canadian Westinghouse Company.

The contract for the entire plant is in the hands of S. J. McQueen & Company, of Fort William, who were also the designing engineers. When the work of construction is completed the Northwestern will be one of the most modern and rapid handling elevators at the head of the lakes.

Cracking of Concrete Roads and Its Prevention by Reinforcing with Steel

ONE of the most serious defects in a plain concrete road slab is its tendency to crack, both transversely and longtitudinally. An interesting discussion of the underlying causes of this cracking, together with a description of the methods used to prevent or to control this tendency, is given by Mr. W. B. Sawyer, Jr., in a recent issue of Western Engineering.

Transverse Cracks.

The coefficient of expansion of concrete is 0.0000055 per degree F. For every degree F. rise in temperature concrete will expand 0.00000055 times its length. If the concrete slab were resting on a frictionless plane this movement would cause no stresses in the slab, but unfortunately we do not have any such ideal conditions. There is a definite amount of friction between the surface of the sub-base and the surface of the concrete slab above it. This varies with the kind of base and the degree of roughness of surface. The friction between the two surfaces resists any movement. When movement does occur, the resistance of friction causes tensile stresses in the concrete. When these stresses become greater then the tensile strength of the concrete, cracks occur.

Change in Moisture Content.

Another cause of cracking, and probably the most important one, is change in the moisture content of the concrete. When concrete is hardened under water or under moist conditions it expands slightly. The expansion varies somewhat with different mixtures, and according to taste is from 0.02 to 0.05 per cent of the length. When concrete is hardened in air and the moisture is evaporated it will contract. The shrinkage may be as much as 0.08 per cent of its length. To counteract this contraction by an equal amount of expansion, because of a change in temperature, a rise of 145° F. would have to take place. This is illustrated by the recent statement of the U. S. Bureau of Standards that concrete roads expand in winter and contract in summer because of increase or decrease in the moisture content. This shrinkage, caused by the drying of the concrete, occurs when the concrete is not fully hardened and its tensile strength is low, probably not over 50 lb. per square inch; therefore the stresses developed by only a slight movement of the slab at this time will produce cracks. These are the characteristic transverse cracks which occur in plain concrete pavement at intervals of 25 to 35 ft.

Causes of Longitudinal Cracks.

Longitudinal cracks may be the result of unequal settlement of fill or similar causes. The road slab is not designed to carry its load as an ordinary floor slab or beam. If the slab is left unsupported, either at the centre or sides, the load imposed will often cause longitudinal cracks.

Consideration of the various causes producing cracks in unreinforced concrete shows that the most important and most frequent are, first, shrinkage of concrete when hardeneing, causing transverse cracks, and, second, insufficient support of sub-base, causing longitudinal cracks. By increasing the tensile strength of the concrete slab it has been found that these cracks can be either entirely eliminated or else so controlled that they are no longer a serious defect. This increased tensile strength is gained by the addition of steel reinforcement.

Placing Reinforcing Steel.

Two systems for placing the reinforcement are now being used in California with success. The first system is for eliminating the longitudinal cracks. The steel is in the form of wire fabric in strips about 5 ft. in width and in length equal to the width of the road to be paved. The main or longitudinal wires are placed at right angles to the centre line of the road. The weight of fabric varies from 22 to 35 lb. per 100 sq. ft., the average being about 31 lb. The method used in placing the fabric is simple and has been found not to hinder or retard the mixing and placing of the concrete. The fabric is placed on the job in proper lengths. These strips are placed one at a time upon the prepared sub-base directly behind the mixer, between it and the alreadp finished pavement. The concrete is then poured in the usual manner and allowed to flow over the mesh. After the shovelmen have properly distributed the wet concrete to the required thickness a small hook is used to raise the wires to the centre of the slab. Care is taken to make sure that the steel is embedded approximately in the centre, as, of course, it would be useless if left resting upon the sub-base. Two extra men per gang are needed for handling and placing the fabric. This method of reinforcing has proved satisfactory. It eliminates the longitudinal cracks. This system of reinforcing has been used extensively by the State Highway Commission of California. They have found it especially useful in preventing longitudinal cracks in pavement that is laid over adobe sub-base.

Controlling Transverse Cracks.

The second system for placing the mesh is designed to control the transverse cracks in the concrete and to increase the distance between them. Some highway engineers control these transverse cracks by placing contraction joints every 25 to 35 ft. Such joints are the weakest feature of the concrete pavement. No matter what type of joint is used, they must be given frequent and careful attention to prevent rapid deterioration of the adjacent pavement. They should therefore be separated as far as possible. This is accomplished by placing the main or longitudinal wires of the reinforcing material parallel to the centre line of the road. The method employed is similar to the first system described, with this difference the mesh is not cut into strips, but is placed on the job in rolls several hundred feet long and of the proper width. These rolls are placed directly behind the mixer. They are unrolled as the mixer is moved forward, thus making the longitudinal reinforcement continuous. The concrete is poured and the steel is raised by hooks to the centre of the slab as in the other systems. Two or three rolls are used, depending on the width of the road. By giving a small lap on each width, reinforcement at right angles to the direction of the road is obtained. This prevents the longitudinal as well as the transverse cracks. The advantages of this system are obvious. It eliminates many expansion joints, prevents longitudinal cracks, and is somewhat cheaper than the first system. This system has been used with great success in Tulare County under the direction of Byron Lovelace, county highway engineer. One stretch of road in partcular is worthy of mention. In building the main highway near Exeter a great deal of adobe soil was found in the sub-base. It was therefore decided to reinforce the entire section. The system described above was used. Although the contraction joints were placed about 600 ft. apart, not a single crack can be found in the mile of highway. Experience with this system of reinforcing has shown that the distance between contraction joints can be made as much as 300 ft. with safety, thus allowing joints to be placed at midday and at the end of a day's run, where the daily run is about 600 lin. ft.

Cost of Reinforcement.

The cost of the reinforcement varies, of course, with the situation of the work and the weight of reinforcement. Basing costs on contract work in central California and with steel weighing about 30 lb. per 100 sq. ft. of mesh, the cost of the material delivered is approximately $1.65 per 100 sq ft. Adding to this $0.10 per 100 sq. ft. for reinforcement in place. The cost per mile for reinforcing a road 15 ft. wide is $1,386. The annual interest charge, therefore, per mile is about $70. This annual cost is much less than the cost of maintenance and repair because of the cracks in plain concrete pavement, and is also largely offset by the elimination of the first cost of nearly all of the contraction joints. A light slab properly reinforced will outlast a heavier slab without reinforcement. Although the slab should be heavy enough to carry the traffic safely, in cases where first cost is of primary importance, better results can be obtained by using a relatively thin slab with proper reinforcement than a slab an inch thicker without it. Under such conditions the first cost is approximately the same in both cases.

The use of steel reinforcement in concrete pavement is theoretically correct, as it furnishes tensile strength to the concrete and enables it to resist stresses that would otherwise produce cracks and which, even with an asphalt top, either reduce the life of the pavement or else increase the expense for repairs. Also it furnishes additional strength to resist forces caused by adverse conditions in the sub-base. In actual practice it has proved its efficiency. Its use has been demonstrated to be economically sound and in the interest of true economy.

How I Lower Costs

TO put sills on a concrete wall have bolts set in the wall, projecting enough to go through one or two planks. This is just as good as using heavy timbers and saves considerable. When one has to repair large sills, planks may be used to good advantage, as the splices can be readily made and there is no waste as in using large timbers.

In some cases where the entire building is to have new sills you can use plank, either built up to the size of the old sills or less.

The quickest way to get the length of rafters is from the square. Measure across from the figure for the rise to that for the run, though if you are adding a bent onto an old barn, the surest way is to get up and measure the old rafter.

To get the length and cuts of the rafters for a combination roof, that is, when one plate is a foot or more higher than the other, as on some poultry houses, the quickest way is to lay the sticks across the building, allowing for the difference in the plates and the desired rise. Then mark the seat cut square across the plate and the top cut lengthwise of the building.

On small building over a water tank when the plate was 6 ft. high, I found I could put the rafter on and a roof board over the plate before putting on the vertical siding. Then I could cut the boards the right length and let them fit up against the roof board, and could shift the rafters a little so as to make them come at the edges of the siding boards. The last saved time while the other saved a board that would have been needed for the frieze. The same idea was used on the ends.

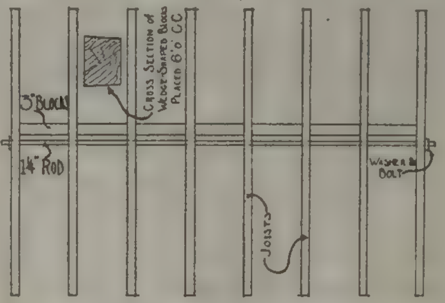
In fitting inside base, watertable or cornice it is best to put the long piece on first then the short, as this will save handling the long ones. An exception might be made in clapboarding, as a long piece can be fitted more easily than a short one.

For ceiling overhead when one is working alone, take a piece of board 18 in. long and 3 in. wide with a slot ripped out from the middle of one end as wide as the ceiling is thick. Use it to hold the stuff up by slipping it over the board to be put on and letting it rest on those already in place.

In shingling use a straight edge. If you wish to lay two courses at once have a short piece of board as wide as the courses to lay on above the straight edge and shove along as you go.—John Upton in Building Age.

How Can Shaky Floors Be Stiffened?

A METHOD is described in the Building Age where a contractor successfully dealt with a floor that sags or springs considerably under moving loads. Take up a couple of floorboards every 6 ft. in length of the floor and fit wedge-shape blocks in between the joists. These blocks should be the full depth of the joists and cut so that the grain will be at right angles to the joist, so that they will not loosen if the wood shrinks.



A Method of Stiffening Floors by Giving the Floor a Crown Shape

Before placing the blocks in position, a hole should be bored through the center of the joists, and a 1¼ in. rod passed through them. The wedge-shape blocks are then fitted in place and the bar tightened up until the floor becomes crown shaped, due to the shape of the blocks. The floor acts like a truss, and is very stiff under moving loads, although its total strength for a uniformly distributed load is not increased.

Engineers and the European War

By Major General William M. Black*

It is an honor to be privileged to address you on a subject of such importance to our country, the duty of the Engineers in war. Although the part played by Engineers in this war is great and the responsibilities of the 'profession are correspondingly large, this war, like all wars in the past, is and must be a war carried on in accordance with the principles of the art of war, which are unchanging and which have been recognized and taught ever since organized armies were first created.

Do you realize that almost the only absolutely modern method of warfare now in use is the warfare of the air? The invention of submarines was made during the American Revolution, and submarines were used successfully, though to a limited extent, in our own Civil War. Gas and flame fighting are of ancient origin. Trench fighting is hardly better known to-day than it was to the veterans of Grant and Lee, of Sherman and Johnson.

Engineer Must Add to His Peace Equipment.

The advances in human knowledge have caused corresponding improvements to be possible in the weapons of warfare. Increased knowledge of chemistry has produced more powerful explosives and improved methods in metallurgy have enabled these explosives to be utilized, by making possible heavier and more powerful guns. Improvements in the means of transportation have enabled larger bodies to be moved more quickly and more readily and to be subsisted and supplied with greater certainty. The telegraph, the telephone and the wireless have afforded a means of prompt communication and have enabled larger bodies of men to be given coordinated action. With such changes, battles are fought on the same principles and won or lost from the same causes as in the time of Alexander the Great. This war has been called a people's war and so it is in the sense that due to modern facilities the entire resources of the people can be utilized to-day as they could not have been utilized in the days of old. It has also been called an Engineer's war because in the quickness of movement and in the works necessitated by these modern inventions the services of Engineers become more conspicuous and perhaps more necessary than in the past. But engineering in warfare has always been essential and it is even doubtful whether the science of engineering does not owe its birth to the works of war. An Engineer myself, I would be the last to belittle the work of our profession. It is a matter of pride that the men of our profession, due to the nature of their employment in time of peace, are, of all the civil professions, most prepared to serve the country in war, but to serve the country adequately in war, the Engineer must add to his peace equipment for professional work. The profession of arms is a profession in itself and it is the profession which deals with the very greatest in magnitude of all the endeavors of men. The effective use of an army which is properly constituted exemplifies the best that men can do in organization, in discipline and in the devotion to duty which causes a man to regard his own life as a thing of small moment toward the attainment of the end sought.

Deluge of Suggestions.

There would be a great amount of effort saved if our people recognized more clearly the existence of the technicalities of the profession of arms. The government is simply deluged with suggestions and so-called inventions for the winning of the war. The records show that about 98 per cent of all of these are without military value and that time and labor have been thrown away by men eager to help, but entirely ignorant of the history and conditions of warfare.

An example with which some of you are familiar is the electrical gun. For years the possibility of such a weapon has been a fascinating line of study to electricians. The principle of the solenoid is the germ. If a series of solenoid coils were to be energized and de-energized in succession sufficiently and rapidly, such a series around a tube can be made to impart a movement of translation and rotation to a projectile. But practical results are to-day impossible. A six-inch service rifle having a length of 20 feet, fires a projectile weighing 110 lbs. with a muzzle velocity of 2,600 ft. per sec., or in other words, the projectile leaves the muzzle with a kinetic energy of translation of 115,500 ft-lb. This energy has been stored in the projectile during its travel through the bore of the rifle, or say in 1/65th of a second. The average power expended has therefore been at the rate of 7,607,500 ft-lb. per second or about 14,000 h.p. or 10,500 kilowatts. These figures are simply approximations and neglect entirely the power required for imparting velocity of rotation and for overcoming the friction in the bore. You can easily estimate the weight and dimension of the generating equipment which would be required for even a moderately powerful gun were all the mechanical and electrical problems of its manufacture solved, and making due allowance for the short-load periods. You can understand the impracticability of transporting the electrical plants required for any number of such guns, and the impossibility of distributing this power over shell-swept ground to guns whose position must be constantly shifted, and which must be put in action on a few seconds' notice. I think that you will agree that until new discoveries give a much improved method of storing or generating electricity, smokeless powder will continue to be the most compact and convenient form of stored energy for guns.

And yet there has been a good deal of time and money wasted in trying to perfect such a gun by men whose patriotism is undoubted, and whose ignorance, also, is undoubted. In other words, if a man has an invention or an idea of an invention, by all means let him work on it, but before he goes to Washington and takes up the time of men busy trying to devise means to beat the Boches, let him make sure that he knows the conditions of war and what he is trying to do to meet those conditions, and then if he is sure of the means, let him present his ideas and inventions to the proper authorities.

We want all we can get and want the best we can get. We want the inventive power of our coutry if it can be exercised to do good.

Inventors' Home Proposed.

There was a proposition made seriously at Washington recently that the United States should provide a fund, of I do not know how many million dollars, and make a Home for Inventors, where any one who thought he had an invention would be able to go, and work it out at the public expense; and recently, although we had a committee of experts there to pass upon these inventions, the results were so utterly unsatisfactory to the inventors that they came in a perfect horde upon the secretary of the navy and the secretary of war, so much so that they had to make a brand new committee of three men, who could be much better occupied to go ahead and do the same thing, and I am only waiting for the next drive of inventors to show that this committee will not suit them one particle better than the old one did.

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* Chief Engineer, U. S. Army, before A. I. E. E. Convention.

In addition, without doubt, there are many men in our country of the highest patriotism who are sore hearted because they are not given something to do directly toward the winning of the war. They do not understand, that some condition peculiar to themselves, possibly age, possibly physical condition, possibly mere ignorance of war and its conditions, compel it that the bit that they must do for their country at this time is to continue in their work in civil life and do their part in keeping up the normal life of the country—in itself a service of importance.

The part which engineers are now playing in the war is a very great one. The records of the American Institute of Electrical Engineers show that out of a total membership of 9143, there are 943 in the service, or 10.3 per cent of its roster. The American Society of Civil Engineers with 8,753 active members, has 11.3 per cent in the service. The American Institute of Mining Engineers 10.4 per cent, and the American Society of Mechanical Engineers 10.1 per cent. But these records are not complete. At the outbreak of the present war there were in the Engineers Corps of the Regular Army about 300 officers and approximately 3,500 enlisted men. At the present time there are about 8,000 commissioned officers and 200,000 enlisted men men, made up of men formerly engaged in works of an engineering character. It is probable that this does not represent much more than one-half of the number of the profession now serving in the army.

Engineer Works in the Van and the Rear.

Let us consider the nature of the work of the Engineer, passing from front to rear of the army.

First in importance is the work of the sappers. They go before and remove obstacles, clearing away obstructions, building bridges and roads, making the trench systems complete, mining, providing light, water, lines for supply (light railways or roads) and military mapping. In this category enter practically all of the branches of the profession. Further to the rear are found the construction and operation of railways, road and bridge construction; the construction of veritable towns for supply depots, with all their accessories, drainage, sewerage, lighting and water supply, construction of quarters and of hospitals, and furthest to the rear, the construction of the ports of debarkation with their wharves, storehouses, railway lines, yards and shops, all with their sanitary systems. Separate from these activities, but necessary for their supply, are the Forestry troops who turn the growing timber into lumber of the dimensions required for the various services. Locomotive and car shop troops are performing essential services. Topographic Corps, Sound Ranging Corps and Camouflage Corps are also among the varied activities of the engineers.

What preparation is required for the fulfillment of these varied duties? For the actual technical work of construction or installation the civil training of the engineer should prove sufficient when the plans which embody the military features have been prepared, or when the military technique has been learned and assimilated. A fundamental of this military technique is that the time element is to be considered rather than money cost and that the work must be done with whatever materials are available. This requires clearness of conception of the results required, resourcefulness and organization—factors also required for civil work.

As stated earlier, due to the very small numbers of the personnel of the corps of engineers of the regular army, reliance had to be placed in the members of the profession in civil life. Confidence in their devotion to country and in their ability has not been misplaced. The results already accomplished prove this fully. Could more have been done? Undoubtedly, had the profession been better prepared for the call.

Sound General Education Requisite to an Engineer.

Will you permit me to say a few words concerning the general training of our engineers, based on a professional experience of more than forty years? The conviction has been forced upon me that in educational matters, as in many other affairs of life, we Americans are inclined to go too fast. The basis for any professional career where the highest is to be attained must be a sound general education. Does anyone of you regret the lessons gained in your own experience? Is not the experience of humanity as shown in properly written history of almost equal value? Would Russia now be in the sad condition existing had her people known that the experiments she is trying have always resulted disastrously? Yet is history thus considered in an ordinary technical course? Again, do you not find a knowledge of the general principles of law and of the special rules of the laws of contracts of value? Are these considered essentials? What is the handicap of an engineer who is unable to express his ideas clearly in spoken and written English? Is this taught thoroughly in our technical courses?

It goes without saying, that the study of pure and applied mathematics is found in all technical courses. But, are these subjects well grasped before their application in special technical courses is studied? Is any faculty of an Engineer of greater value than the ability to form a mental picture of his problems and of their solution? Yet is that study which assists most in this faculty—descriptive geometry—properly apprehended? Is there any branch of the profession which in its application is not based on a knowledge of topographical work, on a knowledge of construction materials and of how these should be used? Is the study of these branches of civil engineering insisted upon sufficiently in the mechanical and electrical courses? In effect would not our professional men be better equipped for their civil work were they not in too great a hurry in their youth to enter directly into life's combat? Does not this war teach that without a long and elaborate preparation down to the last details, an attempted "drive" must fail?

These remarks apply to all engineers, both military and civil. In the rush of war men cannot always be hand-picked for special jobs and frequently it becomes necessary for an available man to be used for the work immediately necessary, irrespective of his previous training. In this supreme test of humanity the best man is he who is prepared to meet any emergency—perhaps not in the most finished way—but to meet it.

There are things that the engineers in this country can do. If they do know enough to give us some ideas for helping along in the killing of Boches, for God's sake let us have them. If they do not, what they can do is to help the supply of men for the winning of the war. We are now short of officers of engineers, very short, and we are going to be very much shorter. We must have educated engineers for this work, and we must not only have the men for the line of work of the army, but we must have mechanicians and artisans and laborers for the special work.

All of you men have spheres of influence—do your best in them, and if you can be used otherwise, and the problem comes up in which we need you, you may be sure you will be called upon. There is is problem now, the supply of men, in which you can help, either by your own personal sacrifice, in going out, or by influencing others.

Now as to soldier work. The movements of drill and the construction methods peculiarly military are easily learn

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Sound Ranging

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This service of the rear i[illegible]

Establishing and Maintaining the Army

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[illegible]

Personals

[illegible]

[illegible]

Obituary

[illegible]

Mainly Constructional

East and West—From Coast to Coast

Bate, McMahon & Company, Col. Robt. S. Low, general manager, have just been awarded contracts by the Dominion Government for the construction of military huts in London and Kingston, to the value of some three-quarters of a million dollars.

On August 15th the Ontario Highway Department formally took over the main trunk road between Ottawa and Prescott as a provincial highway. In the counties of Leeds and Grenville there is now strong agitation for the taking over by the province of the complete road from Kingston to Prescott.

A house-building committee in Peterboro, Ont., recently made a canvass of the city to ascertain how many workmen would be willing to purchase dwellings, if these were provided at a cost not to exceed $2,500, including the lot. Ninety-seven workmen expressed themselves as favorable to the proposition.

Two new companies have taken out letters patent of incorporation authorizing them to carry on business as iron and brass founders, metal workers, manufacturers of machinery, etc. One is the Campbell Howard Machine Company, Limited, capitalized at $650,000, head office at Sherbrooke, P.Q., and the other is the Ingersoll Machine Company, Limited, with head office at Montreal, and capital of $500,000.

The Canadian Cotton Co., Ltd., Marysville, N.B., are undertaking a housing scheme to provide accommodation for employees required at their mill. A contract has been let to Grant & Horne, for the erection of four buildings, 32 x 40, each to accommodate two families. These are the first of a series of modern dwellings to be built by the company for their workmen.

Work on the La Salle bridge in Montreal, which has been so long deferred, is to be proceeded with, the contract for its completion having been let to Fraser, Brace & Co. The contract for this structure was originally let to E. O'Sullivan and then passed into the hands of Alfred Pion, who was unable to complete it on account of difficulty in obtaining materials.

A scheme to drain Boat Lake, near Wiarton, Ont., which has long been talked of, appears to be taking definite shape The permission of the council of the township of Amabel has been obtained, and the parties interested are responsible for the expense. Application to the provincial government for assistance has resulted in the promise of a substantial grant. The necessary expenditure will be about $14,000, and the work is to be carried out this fall. The Rankin river is also to be dredged.

A special meeting of the town planning committee was recently held in Hamilton, Ont., to discuss the housing situation. Representatives of the Manufacturers' Association, Board of Trade, Trades and Labour Council and the civic officials were present. The following proposition was made and is to be presented to the city council: "That the city finance any lot owner who has a clear deed to his property to the extent of $2,000 for the purpose of erecting a dwelling. Such owners must place a cash guarantee of good faith in the hands of the city amounting to 20 per cent. of the gross expenditure on the building, and the city will build the homes at a much less cost than regular contract work."

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Building A Greater Halifax

HALIFAX is rapidly arising from the debris and wreckage of one of the most colossal calamities in the world's history. One of the most outstanding features of the disaster is the way in which the survivors recovered from the stunning shock and proceeded with the work of rescue and relief. Nor did their efforts cease at the completion of this task but with an indomitable spirit and an exhibition of energy and organization seldom equalled, they have planned, and are building, a greater Halifax in the devastated area.

There are few cities in existence that have not outgrown their original requirements before the municipal authorities have awakened to the fact, and prepared for the development. Halifax was no different in this respect from many other cities. The devastated section of the city had many shortcomings, the absence of which will be welcomed in the new plans.

It is seldom that an old established city can offer unrestricted latitude to the ideas of the experts in "town planning," but in this case the best technical services have been retained for the work of planning the reconstruction and carrying out the work. Rehabilitated Halifax should be entitled to the claim of being one of the best planned and one of the most artistic cities in Canada.

As the reconstruction of Halifax is the biggest enterprise of its kind ever undertaken in Canada, and has involved the formation of a huge building organization, under the direction of some of Canada's foremost construction men, it appeared to us that a special issue of the Contract Record was justified and, indeed, called for, covering the whole project comprehensively. The articles which follow, therefore, have been given over to a description of its various phases—the organization and work of the Halifax Relief Commission, with particular reference to the Reconstruction and Architectural Departments; the replanning of the devastated area; the various types of houses to be erected; the damage to the various electrical services and their repair; together with a general outline of the effects of the explosion. In short, we have tried to show Halifax as it was, as it is and as it will be and to describe how the transformation is being brought about.

A Personal Conception

IT is impossible to adequately convey on paper a conception of the destruction done to the city of Halifax, particularly in the devastated districts. The extent of the havoc can only be judged by a visit to the area, where although a great deal has been done towards restoring the shattered homes and buildings, the main evidences of the ruin are still to be seen.

Entire streets were swept away, sheds, depots, piers, tracks and rolling stock destroyed and damaged, and hundreds of houses either totally destroyed or severely wrecked, streets on which many houses formerly stood are now without a building, parts of walls and the foundations being the only signs that dwellings had once existed. The houses in the district were mainly of frame construction, and naturally this class of building had little or no chance of withstanding such a terrific explosion. A representative of the Contract Record and Engineering Review who visited the area last week saw dwellings in every stage of destruction, some with only the foundations existing, others with parts of the walls standing, others with roofs lifted off, others with the sides and fronts blown away, and others in a condition of total collapse many partially wrecked buildings have been, and will have to be, demolished, as they are beyond repair.

Schools, churches, and public institutions suffered severely, and the work of renovating these is going ahead as fast as it is possible to secure labour and materials. Outside the devastated area, the damage was extensive, although not to be compared with that in the north end of the city. There were few buildings in which the windows were not either entirely shattered or broken, and the extent of this class of damage may be gauged by the fact that within a short time 65 acres of glass were utilized.

Concrete and Stone Structures Withstood Shock.

It is a noteworthy fact that while brick and frame buildings suffered severely concrete and stone struc tures were not affected to any extent. The windows of course were blown out, but the superstructures stood the strain in a splendid way. Two instances of this are the city abattoirs, which were in course of construction, and the city resevoir, both built of concrete. Neither were affected.

The Government properties on the water front and the railway stations were badly damaged; in some instances buildings were completely destroyed. The piers on the water-front, particularly those opposite the colliding vessels, naturally received the full force of the explosion, and debris from these and from the tracks were blown long distances. A part of the foreshore was simply removed, and the water in the harbour was turned into a tidal wave, which overflowed the banks for a considerable distance.

High Pressure Activity Achieves Results.

The work of repair and of rebuilding is proceeding very rapidly the devastated area being the scene of extraordinary activity. Here houses are being put into habitable condition, new streets laid out, and new houses constructed. In districts outside this area, houses which received comparatively slight damage are also being restored. The Relief Commission is working under great pressure, but the organization has now got down to a satisfactory basis, and is doing splendid service not only in rebuilding the city but in the rehabilitation department, solving the physical and social problems which have arisen out of the disaster.

As to the future, we cannot do better than re-produce the words of Mr. Ralph P. Bell, the secretary: "We are hoping for Halifax, clean, smooth streets, beautiful and commodious homes, adequate public buildings; in short, a City constructed in such a way as to harmonize with its beautiful situation and surroundings. Our dream is, that it shall be modern in its appointments, comfortable in its homes, and attractive in its appearance. A City, however, is never made up of sticks and stones, but is known generally by its inhabitants. Our ideal is to have the social conditions so that people may delight to visit us and to remain with us; to have the people happy and healthy, and to have that spirit of sacrifice for the public good which should be a characteristic of all communities."

Other Halifax Projects

Apart from the immense work of the Relief Commission, there are two projects which are of outstanding interest in the City of Halifax. One is the Ocean Terminals Scheme, of which we have given a full description, and the other the proposed shipbuilding plant, plans for which are being drawn by Pickings and Roland, Halifax. Practically every constructional firm in the city is working under great pressure, and although there is a very large force of men employed, it is not up to requirements, while in certain directions material is hard to obtain.

The contract for the Ocean Terminals is divided into two portions—that for the terminals proper is in the hands of Messrs. Foley Bros., Welsh, Stewart, and Farquier, and that for a railway line from Fairview to to the Terminals is held by the Cook Construction Co., and Wheaton Bros. The scheme comprises the construction of a landing stage and five concrete piers, extending about 1½ miles. The present contracts cover the railway work and the construction of the passenger landing stage and one pier with basins on either side of it. The work will be practically completed by the end of the year.

The contract for the construction of the new shipyard has been let to the Bedford Construction Co., Halifax. The Halifax Shipyards, Ltd., is the name of the company which is financing the work, the Canada Steamship Lines, Ltd., of Montreal, being also interested. The plans provide for three slips, with a fitting berth 600 ft. long, and the necessary shops. The company has purchased about half a mile of waterfront at the foot of the devastated area, this including the old Halifax graving dock property, which it is proposed to enlarge. Vessels of 10,000 tons will be built. The scheme involves the removal of the tracks of the Government railways, which will adjoin the shipyard.

Wanted, Specific Specifications

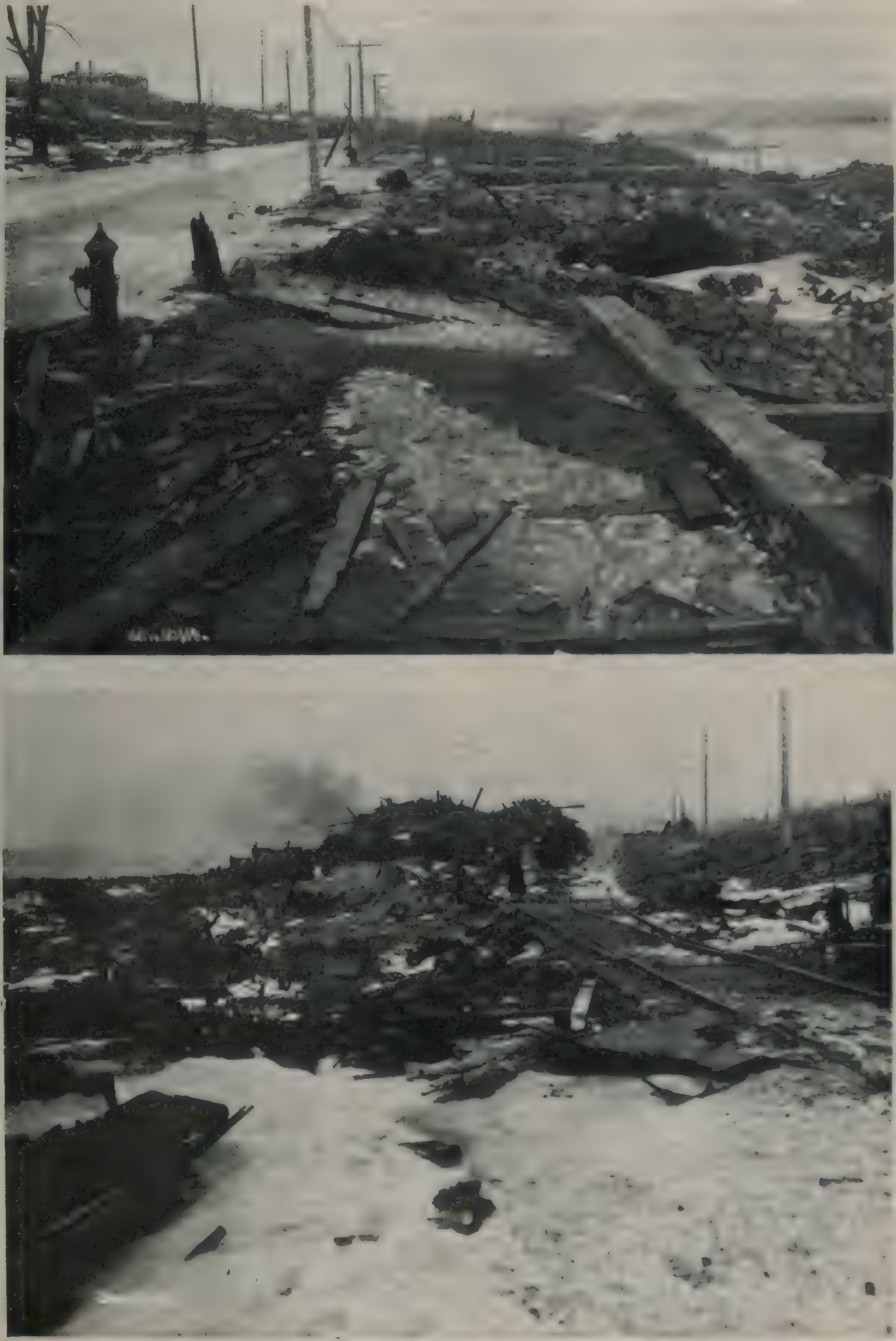
CONTRACTORS, unless they are familiar with the practice of the architect or engineer whose plans they are figuring on, are very often under a big disadvantage, owing to the lack of specific detail in the specifications. The specification is a most important instrument and it is impossible to intelligently interpret the plans unless they state clearly and unmistakably what is expected to complete the contract to the satisfaction of the owner and architect.

The lack of information in the specification, and the different interpretation put upon that specification, is, in almost every case, responsible for the great difference in the tenders of the various contractors figuring on the same job.

This is manifestly unfair to the contractors as well as to the owners, and is, indeed, discrimination in favor of the contractor who has previously completed work under the supervision of the architect and is familiar with his standards. Every job has its individual characteristics and the difficulties to be contended with are seldom, if ever, twice alike. Unfortunately, it seems to have become the practice to use a stock specification with slight additions or variations for every job. The opinion of inspectors as to what constitutes a "workmanlike piece of work," varies with their experience, and unless the class of work expected is clearly defined the contractor is, very often, at the mercy of an impractical inspector, or where the supervision is limited to occasional visits of the architect, the owner is at the mercy of an unscrupulous contractor.

Difficulties, or contingencies, that may be expected to arise, conditions that it is reasonable to expect, such as water or quicksand, should be brought to the attention of the contractor before he submits his bid. If there is a time limit or a penalty clause in the contract, such adverse conditions will surely affect the cost of the work and time required to complete it. No contractor should be expected to work without a fair profit for the his labor and responsibility, and where he is losing money through the cropping up of contingencies of which he might have been advised, it is reasonable to expect him to lose interest in the work to the disadvantage of the owner. Any reputable contractor welcomes intelligent inspection of the work in progress. It is of great assistance to his building superintendent and avoids costly errors. A clearly defined specification with sufficient details is of the greatest value in avoiding mistakes and the contractor feels competent to turn over to a satisfied owner, a piece of work that will enhance his reputation and result in increased business.

Devastated Halifax



Upper Plate—The district adjacent to The Narrows, where the explosion occurred. Buildings were entirely swept away. Lower Photo—Scene by the railway tracks; railway property was severely damaged. The wreckage shown is that of the old sugar refinery which was blown right across the tracks.

The Reconstruction of Halifax

From the debris and desolation of a disaster unparalleled in modern history there is arising a greater city of Halifax. The indomitable courage of her citizens has overcome insurmountable difficulties; the outer world has lent a generous hand. To-day there is certain evidence that the new city that is in the building, under the guidance of men of vision and supreme human skill, will long stand as a monument to the brave determination of her citizens as well as to the highly developed science of modern planning and building.

NO event in Canadian history has had such tragic results as the explosion in Halifax Harbour, on the morning of December 6th, 1917, of the cargo of 4,000 tons of t.n.t. of the French ship "Mont Blanc", after she had been run into by the Belgian Relief Ship, "Imo." The sympathy of the entire civilized world was aroused by the appalling loss of life and the large number of injuries. It is officially estimated that 2,000 people were killed, 5,000 to 6,000 wounded, of which number 1,000 were seriously disabled; 36 persons were made totally blind, and 300 to 400 lost one eye, or suffered serious injury to their eyesight.

The material damage was enormous; one entire district was devastated, and hardly a building entirely escaped. Without going into many details it may be stated that the damage roughly amounted to between $35,000,000 and $40,000,000, this including all marine, railroad and Government property, but exclusive of the indirect or economic losses to individuals or the community. The Board of Appraisal of the Relief Commission estimated on March first of this year that the damage in the affected area was $15,000,000, this applying to the properties specified:—Dwelling houses, $6,476,000; contents, $3,330,000, total, $9,806,000; schools, $342,000; charitable and other public institutions, $222,000 business properties and merchandise, $1,041,000; municipal and other public buildings, $105,000; churches, manufacturing and "specials," $3,484,000; grand total, $15,000,000.

Universal Sympathy and Assistance.

The response to the appeal for assistance was immediate, world-wide and generous. Our neighbours across the line came at once to the rescue with offers of help, and Canadians sent immense stores of clothing and food. The long struggle in France has caused our people grievous losses, but nothing in the course of war stirred the feelings of the Canadian people as did the Halifax disaster. It brought the war, as it were, close to our threshold, and aroused an unequalled sympathetic outburst. This found practical expression in the subscribing of $20,280,000; of this the Dominion Government granted $12,000,000; the British government $5,000,000; and the public $3,280,000. The latter sum was made up of Canada, $1,280,000; Great Britain $705,000; the U. S. A. $558,000, and foreign $197,000. We need not go into the measures taken to give temporary relief beyond stating that temporary hospitals, temporary houses, accommodating 5,000 people, and emergency shelters were built in a very short period, and that clothing, fuel and registration departments were organized.

So much by the way of historical review. We now come to the main purpose of this and the succeeding articles. It is to give details of the work of the Halifax Relief Commission; to show what marvellous progress has been made to repair, reconstruct, and improve the devastated area; to outline the work; to tell what means are being taken to meet the housing needs of the public; and, in short to show a better and greater Halifax is being rapidly built up. The record of things accomplished is one to be proud of showing that Canadian brains, energy and capital are equal to dealing with the greatest emergency in the Dominion's history.

Commission Appointed With Wide Powers.

It quickly became apparent that, while the Voluntary Relief Committees had done excellent service, the work was so stupendous that it would have to be placed in charge of a permanent Commission. The Governor-General in Council on January 22nd, 1918, appointed the following as members of the Commission: Mr. T. Sherman Rogers, K.C., Halifax, Chairman; Mr. W. B. Wallace, Judge of the County Court, Halifax; and Mr. F. L. Fowke, of Oshawa, Ont., Mr. Ralph P. Bell is the Secretary.

Subsequently an Act was passed by the Provincial Legislature conferring further and wider powers on the Commission beyond those given by the Privy Council. The Commission has the power to expend the various sums contributed in any manner it deems proper and "may repair, rebuild or restore any buildings or property damaged, destroyed or lost in or by reason of the said disaster, or compensate the owner thereof, or any person having an interest therein in respect thereof to such extent as the Commission may think fit." The Commission may in respect to the devastated area or any part thereof, prepare a town planning scheme and a set of town planning by-laws subject to the consent and approval of the Commissioner of Public Works, and Mines and upon such consent being given may proceed with and carry out said scheme. For the said purpose the Commission shall within the devastated area have all powers exerciseable under Sections 11, 12 and 15 of the Town planning Act, 1915, by all local boards (as defined in and by said Town planning Act, 1915) heretofore appointed or constituted in respect of the devastated area or any part thereof."

The Commission is given power to lay out, and open any new street, or alter any existing street, and to remove the whole or any portion of any building, wall or fence; to raise or lower the level of any street; temporarily close any street, and break or open the soil of any street for any purpose. It is also provided that any new street, or any existing street which has been altered shall vest in the city, town or municipality, and shall be deemed a public street or road. The Commission has power, in the devastated area, to divert any public or private sewers; to divert water

The Powers Behind the Reconstruction

Col. R. S. Low

Col. Robt. S. Low, well known throughout Canada as manager of Bate, McMahon & Co., builders of the big military camps, was born at East Saginaw, Mich., in 1874, of Scotch parents. In 1880 he and his parents came to Halifax. His business career began with the position of timekeeper at his father's office at Halifax in 1887 and two years later he was appointed assistant superintendent, which position he held till 1894. The following two winters were spent in the United States, and on his return in 1896 he was made superintendent of his father's business. In 1899 he became a partner in the firm McManus, Low & McManus, and in 1900 of Low, McManus & Horne. The name of this firm was changed to the R. S. Low Contracting Co. in 1901, and continued under his direction until 1910. The present partnership in the Bate, McMahon concern was formed in 1912. In August, 1914, Col. Low was appointed by the Minister of Militia, Hon. Lieut.-Col. [illegible] Pioneers, C.E.F., he was made Lieut.-Col. Feb. 1, 1916, and later Honorary Colonel. Immediately after the Halifax disaster, Col. Low volunteered his services to the Halifax Relief Commission and was appointed manager of the reconstruction department, and up to the beginning of June directed the reconstruction work without remuneration. He was then forced to resign to superintend the immense contracts which his firm is handling, including the government office building at Ottawa, the British American Nickel plant at Deschenes, and the more recently awarded contracts for the military huts at London and Kingston, amounting to some three-quarters of a million dollars.

Mr. Geo. Hughes Archibald succeeded Col. Low as general manager of construction on June 1, 1918. Mr. Archibald was born at Sydney Mines, C.B., on July 22, 1877, and was educated at Kings College, Windsor, N.S., and the Massachusetts Institute of Technology, Boston. From 1898-1901 he was construction engineer, United Coke & Gas Co., New York; then for two years in same capacity for the American Coke & Gas Construction Co., Philadelphia; assistant engineer Semet-Solvay Co., Syracuse, 1902-4; private engineering practice, Winnipeg, 1904-6. In 1906 he established the business of Geo. H. Archibald & Co., engineers and contractors, with offices in Winnipeg, Saskatoon, Edmonton and Calgary. In 1917 he became senior partner in the well known firm of Archibald & Holmes, Ltd. Since the Halifax disaster he has been superintendent of construction under Col. Low and thus steps up to the position of general manager with full knowledge and experience of the requirements of the situation.

Mr. G. H. Archibald

Photos courtesy British and Colonial Press.

mains and service pipes; and to remove and re-locate existing hydrants and instal additional hydrants, provided that the various diversions are made in conformity with the sewerage and water supply systems of the city, town or municipality. The powers conferred upon the Commission override similar powers exercisable by any local authority. Any land or interest therein may be expropriated, and the Act makes provision for the appointment of arbitrators to fix the compensation.

"Devastated Area" May be Extended or Altered.

Any contractor engaged in reconstruction work is free from special tax rate, levy or assessment, or license fee, whether provincial, civic, municipal or otherwise. The Commission may from time to time describe, delimit and define any part of the City of Halifax, the Town of Dartmouth or the County of Halifax as the "devastated area." The Commission may also from time to time, later, enlarge, restrict or in any way change the area so described, delimited or defined.

Shortly after the appointment of the Commission, the original Relief Committees were centralised into four departments but as the work extended other divisions were made, and departments were constituted as follows, which is as they now stand: Finance, Reconstruction, Rehabilitation (medical, social service and pensions), Medical, Claims, Housing, Appraisal Board, Legal and Architectural.

The original estimate, made up last winter, indicated that $14,500,000 would be required for re-construction, not taking into consideration shipping losses, government property, and railroad losses, but the tremendous increase in the cost of labour and materials, and also the fact that, as the work goes along the damage disclosed is found to be far greater than was apparent some months ago, has led to the conclusion that the amount will run up into considerably more than the stated figures. In addition to this a pension fund will have to be created, provision has had to be made for those permanently disabled, payment made for material losses, and aid given to a large number of people.

The main branches of the Commission from the reconstruction point of view are the Reconstruction and Architectural Departments. Col. R. S. Low was appointed manager of the former Department soon after the explosion, and with his first rate organizing ability, as exhibited in the construction of the great military camps, at once tackled the problem of temporary building accommodation for the victims of the disaster. Material was difficult to secure and the winter was exceptionally severe, but in record time a very large number of apartments, each with individual baths, were constructed, giving shelter to about 5,000 people, as stated above. Forty of thes apartments, each accommodating four families, were built by the Commission, 12 by Bate, McMahon & Co. (at cost); 24 by Falconer and Macdonald, of Halifax; and 20 by the Eastern Investment Corporation, Ltd., of Halifax. The apartments are of frame and beaver board construction. The contract for clearing the devastated area was given to Messrs. Cavicehi and Pegano, of Halifax.

In June, Col. Low resigned, the period for which he had agreed to help the Commission having terminated. He is succeeded by Mr. George Archibald, of Toronto. Mr. A. G. Ross, of Ross and Macdonald, Architects, of Montreal, is the head of the Architectural Department, and he, in consulation with Mr. T. Adams the town planning adviser to the Conservation Commission, has planned a townsite. It should be added that the services of Col. Low and of the staff of Bate, McMahon and Co., were rendered without remuneration.

Commission's Quarters Erected in 17 Days.

The Commission is housed in two buildings on Sackville street, constructed by Bate, McMahon, and Co. These were constructed as temporary buildings, in 17 days, but are nevertheless of a substantial character. They are each of two stories, and are 41 by 96 feet.

The accounts are handled by a separate department, under the charge of Mr. Glass, of Price, Waterhouse and Co., this firm being responsibe for this side of the work.

Reconstruction and Architectural Departments

THE Reconstruction and Architectural departments and the Appraisal Board, although independent, co-operate with each other in the work of reconstruction and new building. The Appraisal Board is composed of experts, men who are familiar with the various phases of real estate, valuation and contracting. Mr. Melvin S. Clarke, who is in the real estate business, is the chairman, the other members being Messrs. F. S. Whittaker, insurance broker, J. C. Harris, who has had a long experience in contracting work, W. G. Foley, masonry contractor, and George Mackenzie, manufacturer. Early in the history of the Commission a complete and detailed appraisment of the damage done the north end of the city was made, and an appraisment of the south portion is now proceeding. The object was to assess damage to properties as the result of the explosion.

In the case of repairs, the practice is for the owner to make a claim, supported by an estimate from a contractor; the claim is then compared with the appraisal of an inspector of the Board, and an adjustment made. If the owner prefers to do the work himself the Commission will pay the adjusted sum, giving certain amounts as the work proceeds, or the Commission will undertake, through the Reconstruction department, to put the house in order. Appraisals made prior to May 1st have been re-adjusted to meet the rise in the price of labor and materials, but after that date the appraisals stand.

The Board also adjusts claims for property totally destroyed. The basis of this is the condition of the property on December 5th, the day before the explosion. If an owner does not desire to rebuild, the Commission will pay the adjudged value, or if he is anxious to rebuild a better class of house, the Commission will advance a specified amount, taking a mortgage, and accepting payments spread over a given period. The Commission will either build or the job can be let to a contractor, at the option of the owner.

Another and smaller branch of the work of the Appraisal Board was the adjustment of what was known as "Emergency repairs," work such as restoring broken windows which required immediate attention, anid which was done by owners just after the explosion.

Some of the claims for houses totally destroyed were of a rather weird character, but fortunately the Board was able to check these up with the municipal valuation, which this year, for the first time, contained particulars of the value, from the building point, of the various houses, and in some instances gave the rental value.

The Board keeps a very complete record together with the correspondence of the various cases that come up for adjustment. "The aim of the Board," stated Mr. Clarke, "is to be absolutely fair. In some instances, where there are exceptional circumstances, we pay more than the actual value of the house destroyed, in the nature of a restoration bonus. Every case is considered on its merits, and we try to do the best for the owners without wasting public money."

Fixed Schedule of Wages.

One of the most interesting features of the department is the arrangement made for stabilizing wages. For this purpose a contract has been entered into between the master contractors and contractors of the city and the town of Dartmouth and the Commission. Every contractor engaged on work under the jurisdiction of the Commission must sign this agreement, which is as follows:

"By reason of the amount of work required in repairing and rebuilding the damaged and destroyed properties in Halifax and Dartmouth, with the object of maintaining a fair wage for labor employed on the work, and with a view of obtaining a reasonable cost of construction in repairing or replacing the properties of those who suffered loss in the recent disaster:

"We the undersigned Master Builders and Contractors of Halifax, N.S., and Dartmouth, N.S., in consideration of the opportunity of tendering on the various works to be undertaken by the Halifax Relief Comission, and on work to be undertaken by owners in repairing the damage to their properties, either by contract or by day work, hereby agree with the Halifax Relief Commission that no mechanics, laborers, or other persons who perform labor in the construction of works contracted for by us, shall be paid wages in excess of the attached rate of wages to be paid to mechanics, labourers, etc., of the same trades employed by the Construction Forces of the Halifax Relief Commission, and we further agree that no percentage, or bonus, or more favorable schedule of time shall be offered by us as further inducement, in addition to the rate of wages hereto attached."

Subjoined is the schedule of wages agreed on:

Classification	Hourly rate.	Hours per day
Laborers	35 cents	9-10 hours
Carpenters	50 cents	9-10 hours
Painters	55 cents	8-10 hours
Plasterers	60 cents	8 hours
Bricklayers	60 cents	8 hours
Glaziers	55 cents	8-10 hours
Certified Plumbers	50 cents	9-10 hours
Stone Masons	60 cents	8-10 hours
Pipe Fitters	50 cents	9-10 hours
Certified Electricians ...	50 cents	9-10 hours
Other Trades.......	Standard Union Wage & Time	
	Board $7.00 per week.	$1.00 per day.

Fortnightly Returns Required from Contractors.

By this arrangement the commission and the contractors pay the same rates, thus preventing as far as possible the stealing of labor from different firms and the commission by the offer of higher wages. As a check on the contractors, the commissioners require each contractor to send in a fortnightly return showing the names of the employees, classification, number of hours worked and rate per hour, together with the pay roles. The commission is thus enabled to see whether the schedule is being adhered to; if the returns are not forthcoming, the progress payments on the work are stopped, and is a contractor is found to be violating the agreement he is barred from doing work for the commission. Another advantage of the arrangement is that it stops the workmen playing off contractors against the commission and vice versa, in the hope of getting more money. Everyone is paid the scheduled rate, and there is no advantage in the mater of wages, working for one firm as compared with another.

Reconstruction Department Organized Like a Business Concern.

The Reconstruction department is organized on the line of a large contracting firm, specializing on repairs. The department was naturally created in a hurry to meet a crisis, and it has gradually grown into what may be regarded as the equivalent of a business firm. The difficulties were enormous and Colonel Low, Mr. Archibald, and others who undertook the early work under very adverse conditions, had to face a task that only those who were engaged in it can appreciate.

The difficulties are by no means over. The great need is men—and more men. The following appeal, just issued by the Commission, will indicate what the labor situation is:

Labor Must be Conserved.

"The Relief Commission, owing to the shortage of labor, urgently appeals to the public not to press forward inside repairs in any class of buildings except in cases where it may be absolutely necessary in order to make buildings habitable. Local contractors and the commission have on their hands for repair some six thousand houses and in addition the commission in endeavoring to have four or five hundred new houses ready for occupancy before winter. The task is so great that it is doubtful whether the labor available can accomplish it. The Commission's forces are therefore being specially directed to the completion of new houses and to the repair of those not now habitable. In other cases inside work, especially plastering, should be abandoned or at any rate delayed for the present in every possible instance.

"Every effort must be directed to the rehousing of those whose homes were destroyed in the disaster. The situation can be relieved only with the aid of every owner, contractor and builder. Civic and other public bodies, the churches and business houses as well as householders, owe it to the North End of the city to put up with delay, discomfort and inconvenience and thus co-operate with the Commission in its efforts to restore as many as possible of the destroyed houses."

After having been adjusted, the Repair Claims are

Reconstruction—Appraisal Board.

Report No.——————

.... Street. No. ......Tenant ....
Owner .... Address, No. ....St.
Class of building .... Building used for ....
Approximate size of lot—
Frontage ....ft. Depth .....ft. Area .....sq. ft.
Approximate size of bldg.— Depth .....ft. Stories ......
Front .... ft. Height ....
Size of extension .... Depth ...... Stories ....
Front .... Height ....
Assessed value before explosion— Land .... Buildings ....
Estimated value before explosion .... Estimated cost of permanent repairs ....

	Estimated Cost
Foundations	....
Chimneys	....
Fireplaces	....
Concrete floors	....
Lath and plastering	....
Exterior walls and coverings	....
Interior walls and finish	....
Roof—framing and covering	....
Windows—frames, sashes, glazing	....
Doors—frames, etc	....
Stairs and trim	....
Painting	....
Papering	....
Plumbing	....
Gas pipes and fittings	....
Miscellaneous	....

Remarks:

I hereby certify that I inspected the above premises on the ....day of .... 1918, and the above is a true and correct statement.

....
INSPECTOR

Halifax Relief Commission.

From the Appraisal Board.

TO .... Owner.
.... Street.

We are prepared to advance you the sum of ....$ on account of repairs to the above ...., on contracts entered into by you with reputable contractors who have agreed in writing to pay not in excess of the standard scale of wages adopted by the Construction Mechanical Trade Exchange Inc., and this Commission.

This agreement is subject to the following conditions:—

From June 4th forward, progress estimates authorized by the Appraisal Board will be paid only on the 1st and 3rd Wednesdays of each month, and parties desiring such payments must make application for same at least ten days in advance of the pay dates specificed above.

All requests for progress payments must be accompanied by a copy of the pay-rolls of the Contractor or Contractors doing the work, showing in detail the regular hourly rates and overtime rates paid to the various tradesmen.

Payment will only be authorized where the wages do not exceed the Schedule adopted by the Halifax Relief Commission.

The Relief Commission, or their duly authorized representatives, shall have the right, at all time, during the progress of the work above referred to, to enter upon the premises under construction to inspect the work being carried out, to measure up and appraise same and to inspect the payrolls and material invoices of the contractor in connection with this particular contract, before the issue of any progress estimates.

You are to pay the contractor not in excess of 80 per cent. of the work completed at the time of each payment. The final payment to become due the contractor thirty days after the completion of the contract to your satisfaction.

....
APPRAISAL BOARD.
Halifax Relief Commission.

....
As owner of the above named property
I agree to the foregoing.

....
As contractor for the above building with the
owner herein named I agree to the foregoing.

Filing Card. Halifax, N. S.,......................Claim No.

PROPERTY TOTALLY DESTROYED BY EXPLOSION OF DECEMBER 6TH, 1917.

Street..............................**No**..........**Owner**..............................**Present address**..............................

DESCRIPTION OF PROPERTY.

Nature of occupation....................**size of lot**....................**Frontage on Street**....................**size of building**....................

How many stories..........**Cubic contents**....................**Material**..........**Roof**..........**Foundation**..........

How heated..........**How lighted**..........**Sewer**..........**Water**..........**No. of rooms**..........**Basement**..........

Ground floor..........**First floor**..........**Second floor**..........**Finish**..........**Mantels**..........**Verandas**..........

Bay windows..........**Plumbing**..............................

PARTICULARS.

Age....................**Cost new**....................**Mortgage**....................**To whom**....................

Insurance..........**How much**....................**Companies**....................**Rental**..........

Values ....
Replacement **Market** **Investment** **Depreciation.**

BARNS & OUT-BUILDINGS.

Description..........**Size**..........**Age**..........**Cost**..........**Insurance**..........**How much**..........

Companies....................**Rental if any**....................

GENERAL INFORMATION.

City Assessment..........**Land**..........**Buildings**..........**State if you wish to rebuild on the same site**..........

If not, where....................**Remarks**....................

ADVANCE PAYMENTS.

Have you received any money on account of the above property loss..........**How much**..........**From whom**..........

Progress payments if any..............................

The Appraisal Board appraise the loss to the above property at..............................**viz**..............................

on dwelling..........**on barns and out-buildings if any**..........**Total damage appraised, as above**..........

We accept the above adjustment in full for all damages to the above mentioned property..............................
Owner's signature.

I..............................**the owner of the above mentioned property, do solemnly declare that the foregoing statements are just and true in every particular. I make this solemn declaration conscientiously believing it to be true and knowing that they are of the same force and effect as if made under oath, and by virtue of "The Canada Evidence Act"**

Declared before me at Halifax, N. S., this..........**day of**..........**19**

....
A commissioner, etc.

....
Signature.

Forms used by the Relief Commission

sent to Mr. Archibald's department, where the work is carried out. For this purpose the city is divided into six districts, each with a superintendent and foreman, and a number of workmen. The men in the commission's employ total between 2,500 and 2,600.

Keeping Tab on Supply of Materials.

When a job is to be done the various particulars, with estimates, are made up, entered on triplicate forms, one being filed, another going to the Records Office, and a third being sent to the superintendent of the district in which the work is to be carried out. The material is then secured from a district depot, several of which are established, and which draw their supplies from a general warehouse. Advice of any shortage of material is immediately given to headquarters, daily and weekly stock lists being sent to the head office. This enables the purchasing agent to keep a sharp tab on the quantities available, and to make good deficiencies. Materials are purchased on a wholesale scale, and the Commission has its own shunting engine to assist in the quick unloading of goods.

Each day, time and material sheets are sent to the head office. These particulars are kept in the cost ledger, or on a cost card. When the job is completed a final report on the time and labor and material is sent in, checked, and a comparison made with the estimate. The superintendents also send daily reports of the various numbers of men engaged in their districts, as well as the inspector's report on the progress made on the various jobs—a general oversight thus being kept on the work, not only by the superintendents, but by the General Manager.

The plumbing work is handled by the Master Plumbers' Association on a time and labor plus percentage basis. The work is inspected by a representative of the Commission, who also checks the figures before they are O.K'd for payment.

At present about 4,000 houses have passed through the hands of the Commission, or are to be still dealt with. Of these, about 800 are finished; the others are in various stages of restoration, while many houses have not been dealt with.

The central warehouse contains about half a million dollars worth of stock. The old Nova Scotia Car Works are used for this purpose of storage. A part of the works has been turned into a sash and door factory, and about 100 men are employed in this particular branch.

The Transportation Department comprises 100 teams and 35 motor cars and trucks, each superintendent being provided with a car. There is also a machine shop attached to this department for the purpose of keeping the motor cars and trucks in working order.

The men are paid every two weeks at a large pay office at the Willow Park Camp. The time-keepers report to the head office each day the number of hours worked by each man, and from these reports the pay sheets are made up.

The commission found it necessary at an early period to erect boarding-house camps where the men can obtain good accommodation at a charge of seven dollars weekly. A hospital is provided, together with a doctor. Daily reports are sent to headquarters showing the number in residence, received, discharged, and a variety of other particulars.

Personnel.

As before stated, Mr. George H. Archibald is the General Manager of Reconstruction. Mr. J. W. Aldridge is assistant-manager; Mr. W. Bedwin, general-superintendent; Mr. M. S. Dutton, purchasing agent, and Mr. J. C. McCarthy, commissariat manager.

House Construction and Design

WHILE the work of reconstruction is of the greatest importance, in that it provides relief for immediate housing requirements, the construction of new houses and with it the subject of town planning, is probably of more interest to our readers.

This department has been entrusted by the Commission to the well known Montreal architects, Messrs. Ross and Macdonald, of Beaver Hall Hill, who have had offices in Halifax for some time in connection with their work there for the Canadian Government Railways. Messrs, Ross and Macdonald have in hand the design and supervision of construction of the one thousand or more houses which are to be built. Not only are the dwellings on the devastated area of Halifax to be replaced with new ones of the most modern type, but the streets in the area are being laid out anew in accordance with the most recent ideas developed by town planning experts in Canada, the United States and European Countries. The architects, who have been working on these plans for the past two or three months, now have them completed and work will be started on the first group of houses almost immediately, to be followed in a few weeks by other groups of dwellings until the great undertaking is completed.

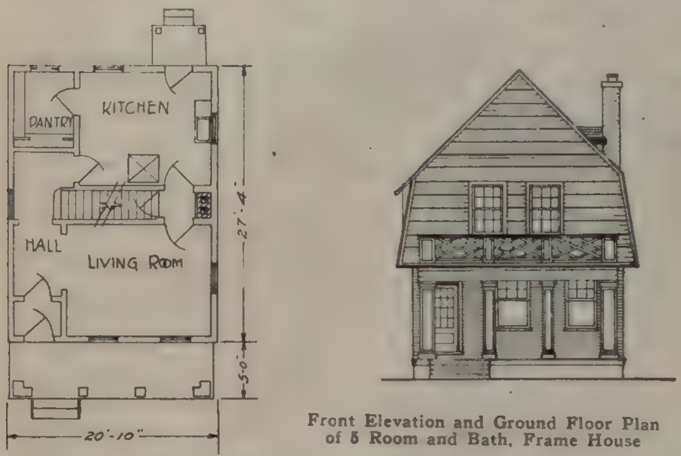
In addition to the hundreds of homes lost, there were also many churches and schools destroyed, and the architects have plans for the rebuilding of these also well under way, so that they can be started as soon as the housing is far enough advanced.

Concrete Block Type of Dwelling Adopted.

In the replanning of the area, suitable sites have been set aside for these churches and schools as well as for parks and play grounds. All the buildings to be erected will be of the most modern construction, and the architects have made a careful comparative study of the available building materials with a view of selecting the most suitable from the point of view of economy of construction as well as of durability and fire resisting properities. A material which will be extensively used is Hydro-Stone—concrete in the form of units manufactured by special machinery under great pressure. These units will be manufactured in large quantities at a plant which is being established near Halifax for the purpose, and the process will be under the constant supervision of the architects, who have made a study of the methods of manufacturing these units at the workshops of the inventors of the process in Chicago.

The machine, manufactured by the Hydro-Stone

Company, molds the block, as stated, under great pressure, and therefore a comparatively wet mixture of concrete can be used, which when properly proportioned to suit the aggregates, produces a dense block practically non-absorbent. In material the block requires just half that needed for a solid eight inch wall, and form work is entirely eliminated. The weight of the finished block is about 80 pounds, and can therefore be set without the use of derricks. The labor cost of setting is somewhat less than the brickwork. The exposed face of the block is finished when it leaves the machine and consequently the rubble or stucco required for poured wall is dispensed with. Variation in texture can be obtained by the use of facing material of different agregates. Other materials will be used also so as to obtain the necessary variety which is desirable in a development of this kind. For instance, roof texture brick with wide joints and structure, cream white in colour, will add to the appearance of bungalow designs and half stories of slate and stained shingle roofs.

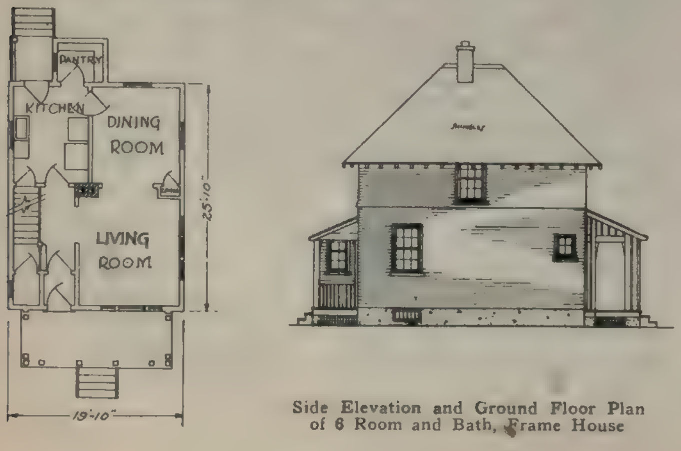


Front Elevation and Ground Floor Plan of 5 Room and Bath, Frame House

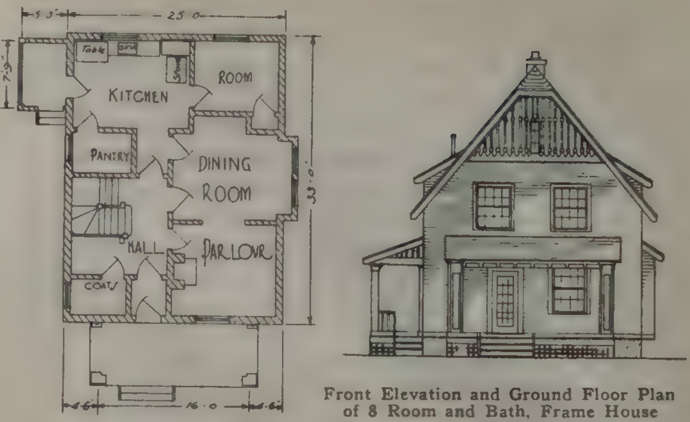
In certain portions of the city, houses of wood treated on the exterior with shingles on clapboards will be constructed, for Halifax has always been essentially a city of wood buildings and the existing conditions have necessarily to be recognized, but the efforts of the Architects will be to improve the character of the city wherever possible and a splendid opportunity for this exists in the large area which was completely devasted by the disaster. Here only fire-proof or semi fire-proof dwellings will be built and the design and grouping of these will be such as to make this section of the city architecturally beautiful.

Provision Made for Public Playgrounds.

As a residential district this portion of Halifax is unsurpassed, having a wonderful outlook over the Harbour, the Narrows and Bedford Basin with the beautiful greenery of the hills about Dartmouth for a background. Other portions of the north end of the city are more suitable for the development of low cost houses which can be obtained at a rental within the means of the average unskilled workman, and here especially the needs ofthe children have been recognized by the reservation of large grass plots between the rows of houses for use as public playgrounds.



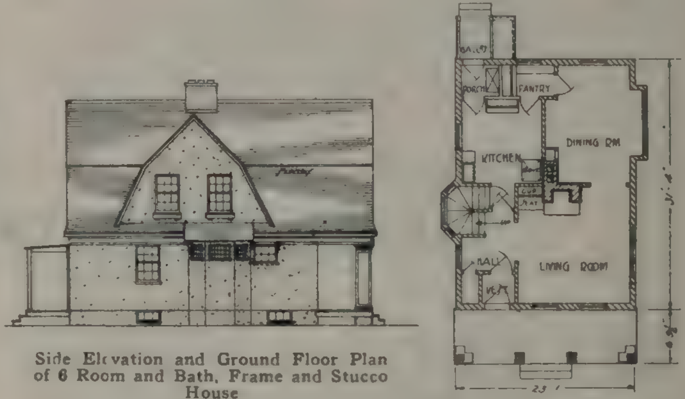
Side Elevation and Ground Floor Plan of 6 Room and Bath, Frame House



Front Elevation and Ground Floor Plan of 8 Room and Bath, Frame House

This is an arrangement which has been tried out with great success in Toronto and which should be especially appreciated in Halifax where the great need for playgrounds for the children is beginning to be recognized.

The Gottingen Street development has been laid out on a basis of ten dwellings to the acre, and the lots range from twenty feet in width for the smallest type of house to fifty and even sixty feet in width for the better residences, averaging in depth one hundred feet.



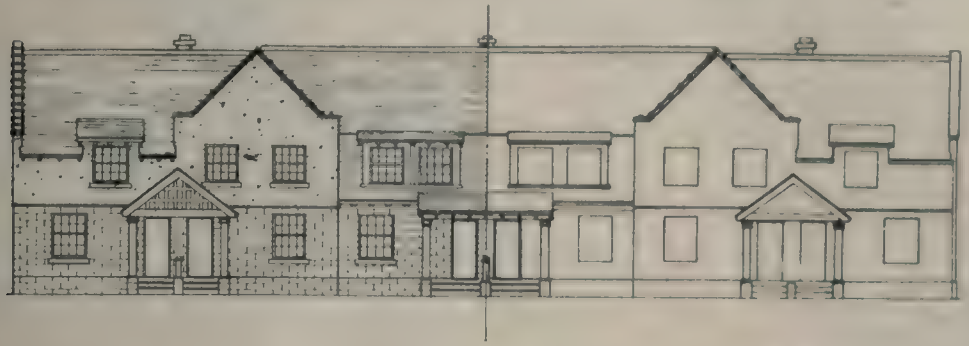
Side Elevation and Ground Floor Plan of 6 Room and Bath, Frame and Stucco House

Various Types and Sizes of Houses

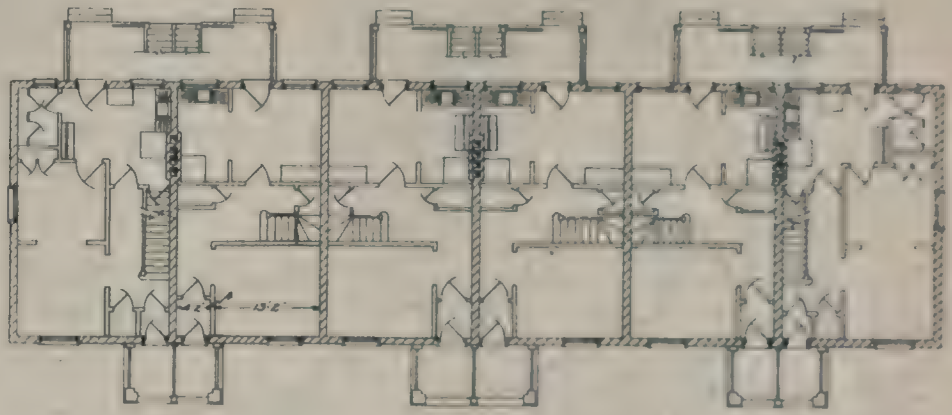
Several types of houses will be built. Single family house, single family house semi-detached, two family house, (one family upstairs and one down), and the terrace or row house, built either as single family self contained houses or two flat houses. The plans provide for various sized houses, but in general it may be said that the first floor will consist of living and dining rooms, kitchen, pantry or storeroom, the bedrooms on the second storey numbering from three to five according to the size of the house, besides a bathroom in every case. The larger bedrooms range from 10 x 12 to 12 x 14, the small bedrooms 80 square feet; the living room, 10 x 12 to 12 x 14; dining room, 9 x 12 to 12 x 14; kitchen (where there is no separate dining room) 10 x 12 to 12 x 14, kitchenette (only where there is a separate dining room) minimum area of 70 square feet with a minimum width of 6 feet. The height of ceilings in the main rooms is not less than 8 feet 10 inches, with a minimum height of 8 feet for bedrooms.

Every bedroom has a clothes closet opening from the room, and with regard to ventilation every room has at least one window opening directly to the outer air. The houses have porches. Special attention has been given to the plumbing while the heating will be by means of hot air.

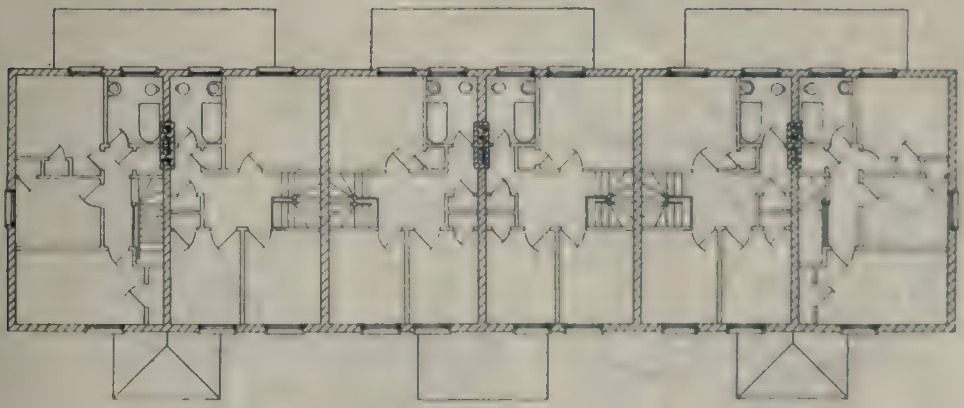
With regard to the interior work, the trim will be of B. C. fir, with a varnish finish, and hardwood, with double floors. The walls and ceilings will be of plaster. The cost per house is estimated to be $1800 for a four room house, with a bath, to $2500 for detached houses.



Front Elevation of a 6 Family Hydro Stone and Stucco House



Ground Floor Plan, 6 Family Hydro Stone and Stucco House



Second Floor Plan, 6 Family Hydro Stone and Stucco House

Five Hundred Houses Under Way.

At present five hundred houses are under construction, three hundred and fifty of which are of the Hydro-Stone type, Bate, McMahon & Company have the contract for the foundations of one hundred of these houses. Falconer & Macdonald and Silliker & McMann have contracts for a number of houses of the wooden type, on thirty three feet, lots, and the Reconstruction Department of the Commission are also building sixty of these houses.

The new ship-building enterprise which is being started in Halifax by Montreal interests will bring thousand of new workmen to the city and most of these will find houses in the district being developed by the architects; indeed the shortage of houses in Halifax was so great even before the explosion that it would have been impossible for these new residents to find house. One of the most prominent real estate men in the city has estimated this shortage even at that time as five hundred houses and as more than a thousand were destroyed on December 6th, it will require heroic measures to fill the need. These measures are being taken in the wisest way, with careful consideration of possible future developments and future growth of the city and with the best professional advise obtainable.

The Planning of the New Halifax

Economic Considerations Given First Place—Six Schemes; Two for City, Four for County—Diagonal Streets Reduce Grades, Expedite Traffic

By Thos. Adams*

THE work of planning the devastated area in Halifax and the extensive areas of unbuilt upon land within and surrounding the city, has been proceeding for the past six months. Good progress has been made in regard to the fixing of the boundaries of the areas, surveying lines and fixing grades for main arterial thoroughfares, determining building lines, selecting portions suitable for residential and industrial development, and carrying out the preliminary procedure under the Nova Scotia Act. It is too early to say much of a definite character with regard to the details of the scheme, but some of the tentative proposals may be indicated.

Areas of Six Schemes.

The devastated area, that is the area more or less completely destroyed by the explosion, comprises 325 acres. This area, shown on Map A, is being dealt with by the Halifax Relief Commission under the statutory provisions included in the Halifax Relief Act. The remaining area indicated on Map A is included in the scheme proposed to be prepared by the Town Planning Board of the City. The Halifax County Council is preparing four schemes as shown on key map B and numbered 1 to 4. The areas of the six schemes are as follows:—

Devastated Area	325
General city area	2,960
(1) County area, west of city	5,508
(2) County area, east of Halifax Harbor	4,430
(3) County area, east of Halifax Harbor	3,800
(4) County area, west of Halifax Harbor	4,400
	21,423

The town of Dartmouth has not yet decided to prepare a scheme but in order to complete the proper development of the east shore of the harbour it will be desirable to have a further plan prepared for the area of that town. The advantages to be gained by the preparation of a scheme are so great that it is certain

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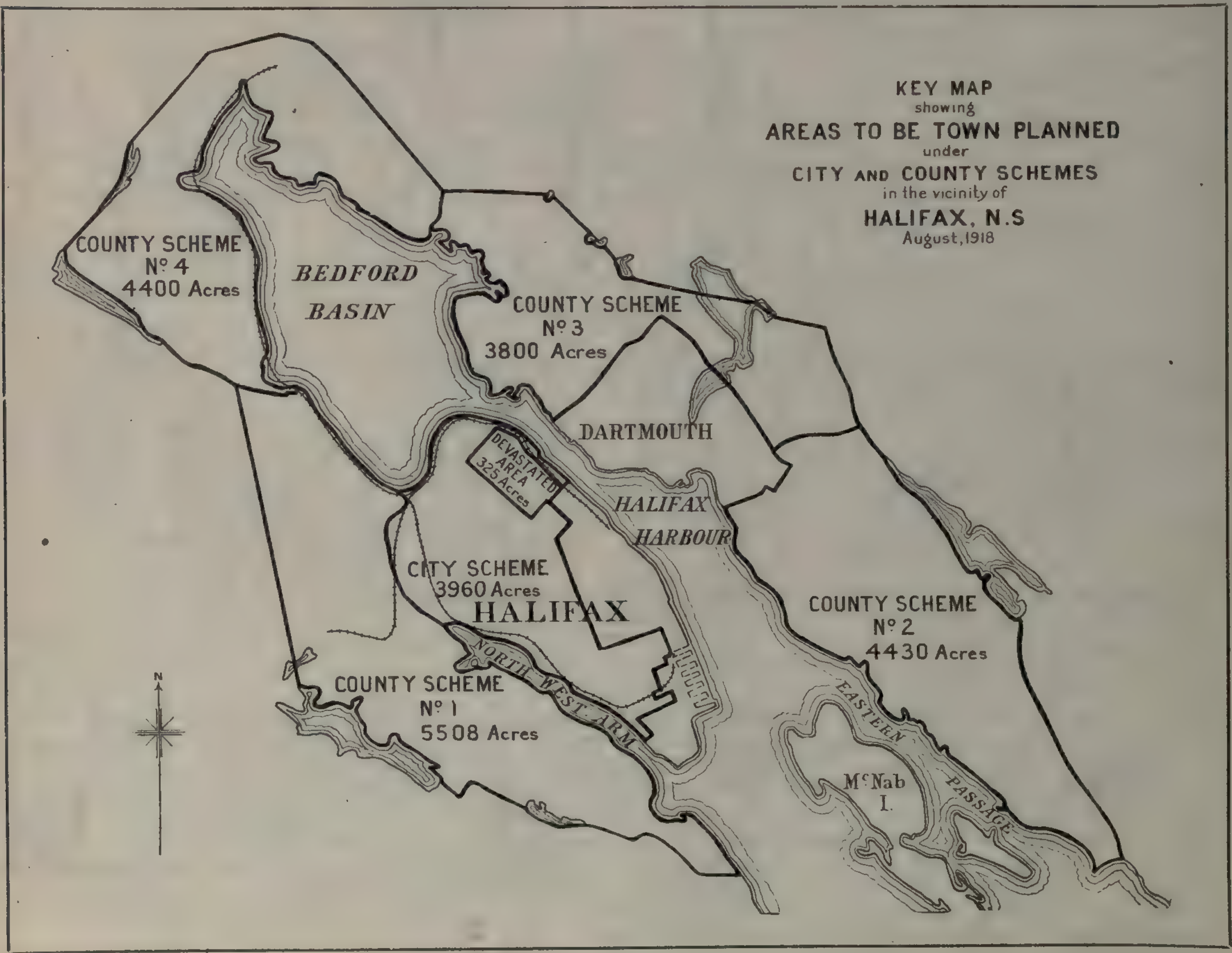
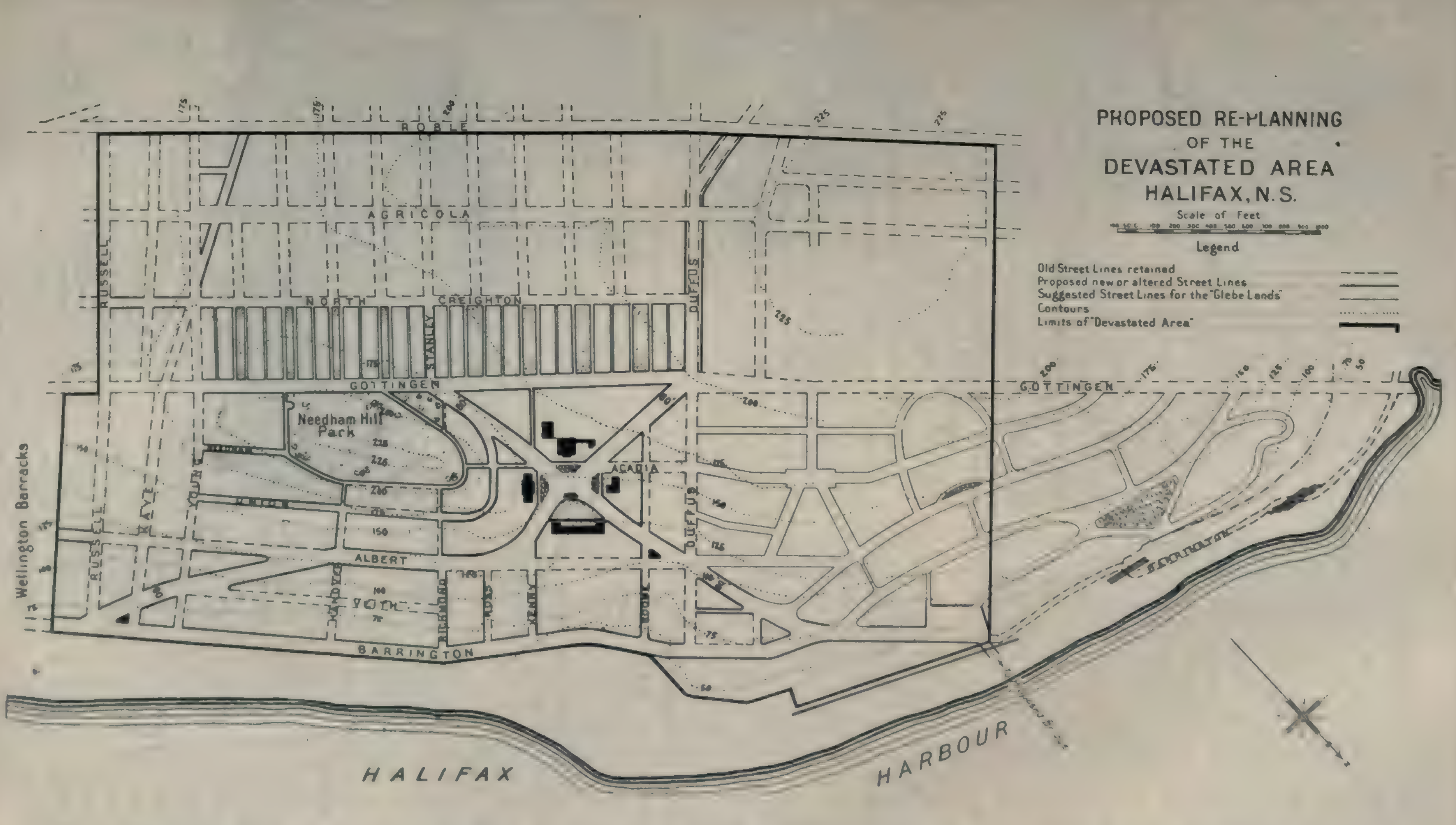
*Town planning adviser, Commission of Conservation.





Plan C.—The main features of this tentative scheme for the replanning of the devastated area, as shown above, is the substitution of diagonal streets for the old rectangular layout. Two main diagonal thoroughfares are provided, 80 ft. wide, of which the grades will generally be from 4 to 5.5 per cent., replacing grades of 8 to 20 in the former street arrangement. While 508,570 square feet of land is included in these new diagonal streets, there is a possible saving in streets, waste land, etc., of 443,140 square feet. Fort Needham, which is one of the highest points in the city, is to be developed into a park. At the northwest corner of the devastated area is shown the proposed location of a bridge across the narrows at Dartmouth.

that Dartmouth will eventually come into line with the neighbouring municipalities.

Objects of Schemes Apart from Reconstruction of Devastated Area.

Nothing will be included in these schemes unless for some useful purpose connected with the economic development of the land or for protecting the health and well-being of the inhabitants. It happens, as it usually does, that what is most useful, convenient and healthy is also best from the standpoint of appearance and amenity, but no aesthetic object is being sought for its own sake. This is not a time, nor are the conditions in Halifax such that the occasion is opportune, for spending money on purely ornamental purposes. At the same time, full regard is being paid to the practical advantages of scientific methods of planning and to the commercial value of those at reasonable cost. The two chief enemies of proper planning are the self-styled "practical" man, without scientific knowledge or imagination, who has been running things so badly in the past, and the unbalanced enthusiast who represents the other extreme and paints beautiful pictures without considering how they can be carried into effect.

The necessity of preparing schemes that are practical, both from a financial and from an engineering point of view, is not solely due to the need for economy. One must be practical in method to get a thing done at all—and it is waste of time to set up idealistic utopias of what we would like to do but cannot do. The Halifax schemes will be prepared on lines that can be carried out and enforced, however far short they may be of the ideal one would like to attain.

The following are among the matters which will be dealt with in the provision of each draft scheme, which will be in the form of a local Act of Parliament.

Provisions of Schemes.

1. Providing for submission and approval of future plans of sub-divisions to secure conformity with general plan of main thoroughfares and principles of development laid down in the scheme.
2. Fixing: (a) varied width of streets to suit traffic requirements, and height, character and density of buildings; and (b) height, character and density of buildings to suit width of streets.
3. Regulating methods of financing street and sewer construction to secure equitable apportionment of cost between owners and public body according to benefit received.
4. Providing for construction of main trunk streets on sites determined in scheme.
5. Widening of streets, modification of sub-divisions already made, adjustment of boundaries of estates, and diversion of highways.
6. Fixing of open spaces, building lines suitable for residences, business premises, etc., and proportion of lots to be built upon for different purposes.
7. Prohibition of bill-boards, limitation of number of dwelling houses to acre and obstruction of water courses.
8. Regulations regarding appropriation of lands, inspection, compensation and betterment, agreements, penalties, appeals, suspension of by-laws, etc.

Plans.

Accompanying the schemes will be maps showing inter alia the following:—

(a) Areas restricted for different purposes (i.e. residential areas, factory areas, etc.)

(b) Position of main trunk streets to form chief lines of communciation. (Only main arteries will be included—all intervening details of developing will not be fixed by the scheme but merly regulated under the principles laid down in the scheme. This is necessary to secure elasticity and allow the scheme to be adaptable to reasonable modification to suit change in condition.)

(c) Widenings modifications and diversions of streets.

(d) Areas restricted as to density of building on land units determined in scheme.

(e) Open spaces settled by agreement or expropriated.

(f) Building lines so far as needed to be fixed on the map.

The complicated legal difficulties involved in carrying out a scheme dealing with the above matters in such a way as to secure real public advantage without much cost to the municipality and without loss to the owners of land, will be appreciated by most people. It is because of these difficulties that a town planning scheme requiries a considerable period of time for preparation. When prepared it is much more than worth the trouble, but its value has a definite relation to the time and patience exercised in preparing it.

Street Plan of Devastated Area.

One of the simpler and more interesting aspects of a town planning scheme is often regarded as the whole of a scheme, namely, the plan of lay-out of the streets. Plan C. shows the tentative street scheme prepared for the devastated area. The original lay-out was on the usual rectangular method—wasteful and inconvenient to a degree.

The maximum grades found on the nine principal east and west streets were 8, 10, 11, 12, 13, 14, 15, 18 and 20.

Apart from the inaccessibility of the land owing to the steep grades of these streets, many lots were rendered useless for building by the straight north and south streets cutting across the steep grades at right angles.

A Typical Wreck—Gottingen Street

In re-planning the area regard had to be given to the existing streets, sewers, etc., and no radical change could be made in the rectangular plan without "scrapping" a great deal of expensive local improvements. It would have been a great advantage if the whole area had been expropriated and re-planned, but the initial cost would have been too heavy, having regard to the funds available for all needed purposes. Without interfering unduly with the existing street system two new diagonals were laid out following lines which permitted easy grades and converging on a central square round which it is proposed to erect some of the principal public buildings. One of these diagonals will be used for a street railway connection between the low level of Barrington St., which approximately follows a 50 ft. contour line, and to the high level of Gottingen St., approximately 200 ft. above O. D.

The widening and diversion of Barrington Street and the construction of two 80 ft. diagonals converging and intersecting at the square before they reach Gottingen St. will provide the devastated area with an excellent system of main arteries. The grades of the diagonals will generally be from 4 to 55 per cent. For one short length of the least important street it is 6.5, but greater lengths are as low as 1.4 per cent. These grades replace those of 8 to 20 already alluded to. The benefit to be derived from this improvement alone will be realized when it is pointed out that the east and west streets form the only direct means of access between the busy north end of the harbour and the important section of the city which is served by the main artery of Gottingen St. and its tributaries.

The importance of the square as a distribution centre for traffic from all directions will be noted. Right angled collision points with the main north and south arteries of Gottingen and Barrington Streets are avoided.

Re-planning is always expensive and wasteful. Certain land will lose its building value because of the intersection of the lots by the new digonal streets. This is the price we have to pay for want of planning in the first instance. But on the whole it is hardly conceivable that a more economical scheme could have been prepared. Although 508,370 sq. ft. of land is included in the new 80 ft. diagonals, central square, etc., there is a posible saving to be obtained of 433,140 sq. ft. in streets, waste land, etc. recommended to be converted into building land. The balance, consisting of extra land taken up for new streets as a result of the plan, is only 75,230 sq. ft.

There will have to be considerable excavation and filling in connection with the constructon of the new streets, but care is being taken to equalize both, and to prevent unnecessary injury being caused to the frontage land.

On the whole the cost of the scheme of re-development will be small, having regard to the permanent advantages to be obtained.

Replanning of Streets

HALIFAX is built on a peninsula with the ground sloping steeply upwards from the harbour, Belford Basin, and the north west arm, the three bodies of water almost surrounding the city. There is a comparatively level plateau at the summit. In the lay-out of the city the streets running north and south are fairly level, running parallel to the harbour, while the east and west streets laid out at right angles to the former are normal to the hillside, giving the heaviest grades obtainable.

The disaster on Dec 6 afforded an opportunity of remedying these conditions in the large area destroyed. The City Council immediately recognized the necessity of this improvement, and at a meeting on Dec. 12 adopted a report recommending the acquisition of the devastated area and replanning and rebuilding the same in accordance with modern practice. Legislation was enacted appointing as commission to carry out the replanning of the city.

A reference to the plan of Halifax shown on Page 681 will show three parallel streets on the harbour slope, runnning from north to south, Barrington, Brunswick and Gottingen streets. Albert street is practically a continuation of Brunswick street, divided by naval and military property. At no distant date a bridge will be built across The Narrows to Dartmouth somewhere in the region of Leeds Street

At Fort Needham there is a high knoll which is one of the highest points in the city, commanding an extensive view of the water and surrounding country. It is proposed to develope this into a park to replace a similar area used for park purposes on Barrington street at Roome street.

Direct Routes, Easy Grades.

One of the main points guiding the replanning was to provide wide and direct streets and easy grades to carry the traffic from Dartmouth and the portion of the city north of Rector street to the top of the plateau Gottingen street where it can spread out in various directions as required.

Another point considered was to provide similar means of outlet for the Northbound traffic to reach the corner of Duffus and Gottingen streets, where it can get to the city limits via the former street and Lady Hammond Road in a direct route and with easy grades.

Adjustment of Street Widths.

A third object was the extension of Brunswick street through the Admiralty and Military grounds to link up with Albert street. This cannot be consummated at present owing to delays in dealing with the Imperial authorities, but will be eventually accomplished. Several of the streets on the devastated area are sixty feet wide, these have been reduced to forty feet. Streets have also been developed around the slope of Fort Needham. The main boulevards in the districts now being laid out under the town planning scheme are to be 80 feet in width and the secondary streets varying from fifty 50 to sixty 60 feet in width.

All under ground work such as sewerage, water and electric systems will be installed as the building contracts are carried on. Concrete Curbs and Sidewalks will be built throughout the building area and paved service lanes are to be constructed in the rear of all properties and will contain service features of every description.

Toronto is this summer making a new low record in the construction of local improvement works. Apart from work on the Bloor St. Viaduct, the only roadway being built is a macadam approach to Strachan Ave. bridge, and the only sewers are a storm sewer on Russell Hill road and the Summerhill Ave. section of the Moore Park outlet. No sidewalks at all are being constructed. As compared with this, in the summer of 1913 work was carried out on 80 roadways and 123 sidewalks, and not only were a large number of additions being made to the civic system, but several new systems serving whole districts were under way.

Prompt Relief for the Distressed

Immediate Shelter Provided for 6,000 Homeless Survivors—Material and Labor Shortage Coped With

By Col. R. S. Low

ON December the Sixth Nineteen Seventeen, the writer accompanied by Mr. G. C. Hurdman, M.P.P., of Ottawa West, while crossing from his office at Elgin Street met Major Cantley, son of Colonel Cantley Chairman of the Nova Scotia Steel Company, who informed us that the City of Halifax was on fire and mentioned a ship being blown up at the Ocean Terminal which had practically wiped out half the City. My first thought was of my family who-lived in Halifax about three quarters of mile back from the Terminals, as the writer thought when he heard the story first that it was the new terminals that was meant as he understood Munition ships were being loaded at the new Piers. I immediately went to the telephone and called up Montreal to secure accommodation on the first train out for the East. In the meantime notified my office to offer the services of the Bate, McMahon Company to the Department of Railways and the Mayor of Halifax, also the Public Works Department, as I felt that our company could be of great assistance in rehabilitating them as quickly as possible.

The information before leaving Ottawa was very meagre but while enroute down I received a wire from my sister at Halifax which reached me at Levis, Quebec, having been forwarded from Ottawa, in which she stated that my mother and all my folks were safe and showing in her telegram that she had the contractor's idea thoroughly imbued in her (as our forefathers before us all were contractors) she wired me the sizes of the glass required, as the window panes had all been broken in the house and wanted me to send it down from Ottawa knowing that it would be impossible to get it in Halifax to make the immediate necessary repairs.

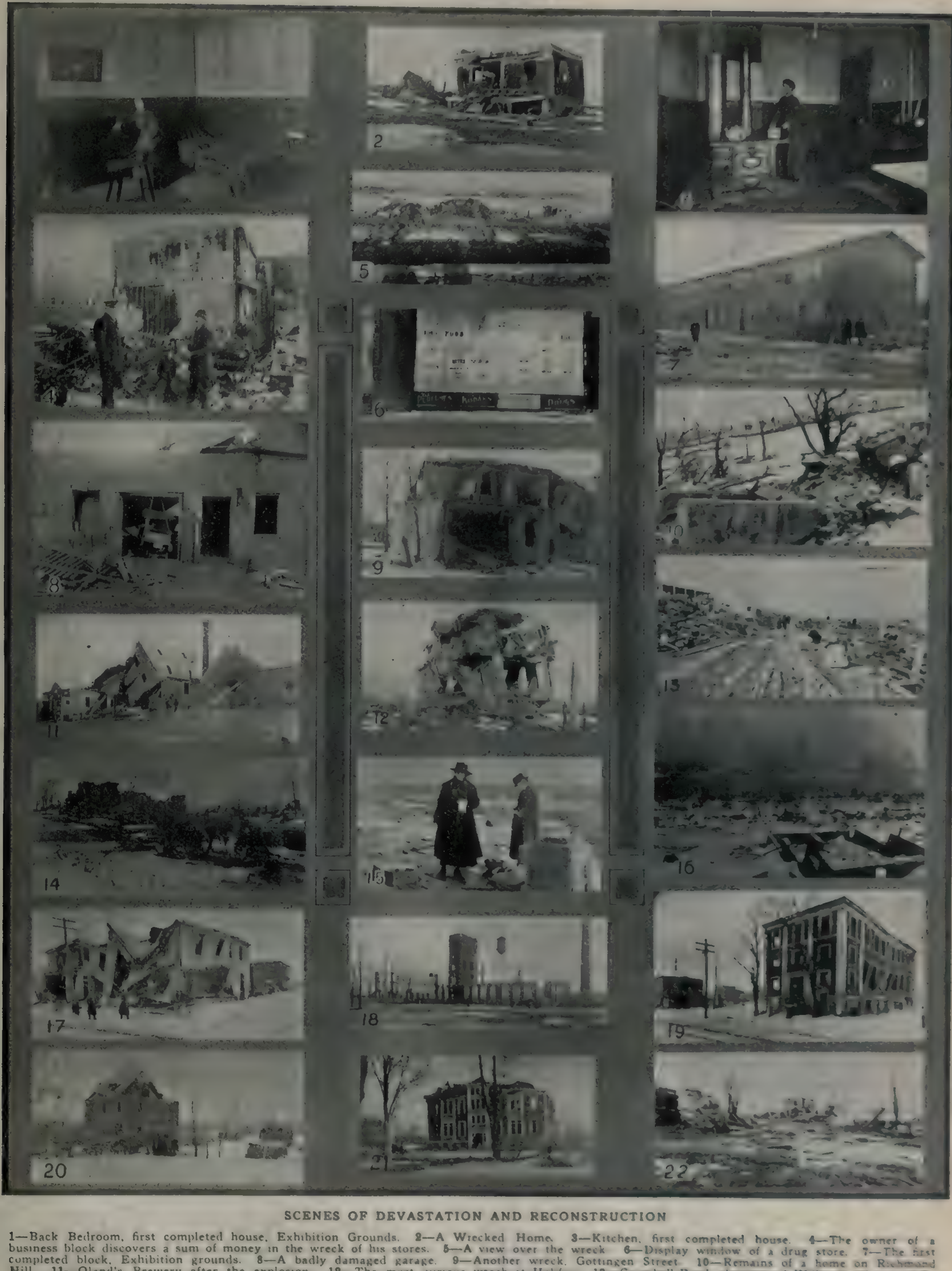
Offices of the Relief Commission

While enroute down I received wires from the city of Halifax asking me to come on at once to Halifax to assist them in their time of need. After a very strenuous trip from Moncton, which we reached on time in a howling blizzard, we got off the track several times and did not pull into Halifax Ocean Terminal until Saturday afternoon. I immediately reported to the City Club and started the wires moving in, getting in all necessary supplies and labor.

You can readily understand when you picture six thousand people homeless and the balance of the houses in Halifax wrecked,—the majority of the people were living in one room in which they had protected the windows to keep out the elements. All this was the condition which we had to relieve as quickly as possible. The first point was to try and relieve the distressed, for everyone, or nearly everyone who had been affected by the disaster, their men had remained at home to try and relieve the distressed of their own people.

A view of temporary houses for suffering Halifax

After my appointment I immediately sent out a call to all the mayors in the Maritime Provinces to send us in all the carpenters and glaziers they possibly could, immediately, and if necessary have them taken off their own work for ten days or as long as they possibly could until we could get workmen in from outside points. I may say without any hesitation, the response was marvelous. Every village and hamlet in the vicinity sent along their quota and if it had not been for the prompt response the suffering would have been more tremendous. Our next step was to get bunk houses to house these people in. The six thousand inhabitants who were homeless were scattered around amongst the institutions and the barely habitable houses all over the city. We immediately took steps to get into any of the schools and also the curling rinks or any halls that were habitable and in a very short while we had camps ready for four thousand men. In the meantime we purchased all the glass and beaver board we could in all the provinces and had it rushed in from outside points from even as far as Pittsburg, as the readers of this can readily understand that there wasn't one per cent. of any kind



SCENES OF DEVASTATION AND RECONSTRUCTION

1—Back Bedroom, first completed house, Exhibition Grounds. 2—A Wrecked Home. 3—Kitchen, first completed house. 4—The owner of a business block discovers a sum of money in the wreck of his stores. 5—A view over the wreck. 6—Display window of a drug store. 7—The first completed block, Exhibition grounds. 8—A badly damaged garage. 9—Another wreck, Gottingen Street. 10—Remains of a home on Richmond Hill. 11—Oland's Brewery after the explosion. 12—The most curious wreck at Halifax. 13—Campbell Road, skeleton of Willis foundry on left. 14—Desolation under the moonlight. 15—Richmond Hill, two sufferers who have lost home and relatives find insurance policies in the ruins. 16—Another view overlooking the narrows. 17—St. Joseph's old hall, Gottingen St. 18—Remains of the Dominion Textile Cotton Mills. 19—A badly shaken apartment house. 20—Elm tree, 2 ft. in diameter, in the foreground, broken across. 21—St. Joseph's school, least damaged side. 22—Campbell road near the narrows.

of glass in any of the buildings left whole in the city, nor as far as two and half miles in air line from the seat of the disaster was there a pane of glass left. Through the co-operation of acting city engineer Mr. Harry Johnstone, who worked like a Trojan from morning until night, we were able to house these people and get the water and sanitary conditions into the camps and proceeded with as rapidly as possible and relieve the afflicited people of the City.

We secured offices in the Halifax Hotel and established at once a permanent force to keep records of all the repairs and issue orders for glass and beaver board for a great many of the people who had done their own temporary repairs. Mr. George Archibald, who succeeded the writer as Manager of Reconstruction from the first of June this year, and who had offered his services, was appointed general superintendent and with the co-operation of his firm and staff and my own firm we were well able to cope with the situation. To-day to look back on what was accomplished it is simply marvelous. To the workmen of all parts all over Canada, who rushed to the scene when I sent out the call the writer cannot say enough. When you realize the wintery weather, zero a great many times and below it, when these men with bare hands were putting in glass and with frost bitten fingers stuck at the work until we had scores and scores of them laid up and some of them had to have their fingers amputated through the chivalry they had shown in connection with this repair work, then and not till then can you realize the heartfelt sympathy of these workmen. Through the loyalty of the workmen, as I have already stated, should go all the praise as they were the heroes of this occasion, and each and everyone of them deserves the thanks of the citizens of Halifax, for the wonderful way in which they took hold. It is useless for men to specify any particular part of Canada or any particular town, altho I may mention the cities of Yarmouth, Sydney, Amherst and St. Johns, to say nothing of our friends from the Quebec Provinces and even as far distant as Toronto and London, all of whom did their bit towards relieving the distressed. Also the New England States did yoeman work sending down glaziers and supplies. To the Government of Maine especially and to the Massachussetts people we owe a debt of gratitude that we never can repay.

Wintry conditions handicapped construction work

While the temporary repairs were going on another department of our reconstruction organization undertook to rebuild all apartment houses containing eight groups in each, consisting of living room, kitchen and two bed-rooms with bath room complete for homeless people whose houses had been destroyed in the disaster. Forty of these we built on the Exhibition Grounds and forty-four were built by tender on the South Common as well as ten of them built by the Bate, McMahon second organization on the Garrison Grounds containing sixteen apartments, two and three rooms, with hot and cold water in every apartment. The rapidity with which this was proceeded with, figured out an apartment per hour, which, considering the enormous quantities of building materials which had to be assembled in the winter, was simply marvelous, but as I have already stated the transportation companies did everything in their power to facilitate the movement of freight and deserve a great deal of this gratitude as well as the loyalty of the workmen which I have already mentioned. We worked from daylight until dark as I have already mentioned, Sunday and Saturday to push this work along so as to take care of the distressed and homeless unfortunates.

Reduce Cost of Standardization

Standardization must play the important role in building construction if we hope to reduce the cost of building construction after the war. The old cry that architectural effects cannot be obtained by the use of stock materials is absurd and needs no further argument than the calling of attention to the long list of already standardized materials used in the construction of all types of buildings, and which includes such major materials as steel, plumbing fixtures, brick, lumber, etc.

The list of standardized materials could be lengthened to include almost everything used in the construction of a building. There is no logical reason why the mill man should be compelled to make a dozen new bits for every new job, or why a window should be just a little larger or smaller than the stock size, or why a staff lead or trim should have just a little different curve than the one designed by the same architect on the last piece of work.

This waste of time, which means increased cost of construction, is not solely confined to the millman's work, but is equally true of almost everything in building construction not already standardized. We can hope for but little reduction in the cost of building construction, due to decrease in wages, as the history of the building trades proves conclusively that wages never decrease as long as business continues good. So far as a standardization of wages is concerned, we can hope that wages will be uniform—that is, labor in one city should not be paid more for the same work in any other city, simply because it has been able to force a higher wage through collective bargaining. Wages should be fixed fairly and scientifically.—Philadelphia Ledger.

Halifax City Engineer Recalled

Major F. W. Doane, city engineer of Halifax, N. S., recently returned to this country from overseas at the urgent request of the Halifax Commissioners. Major Doane has been acting as quartermaster in some of the English military camps.

Reconstruction of Consumers' Cordage Plant at Dartmouth

THE town of Dartmouth, just across the channel from Halifax, suffered, in proportion, even more severely. The largest establishment in the place was the factory of the Consumers' Cordage Co., located about half a mile from the spot where the Mont Blanc blew up, was badly wrecked by the explosion. A description of the repair and reconstruction of the buildings, the difficulties met with, and the effects of the concussion, will, we believe, be of interest to our readers, as more or less typical of conditions prevailing at the scene of the disaster.

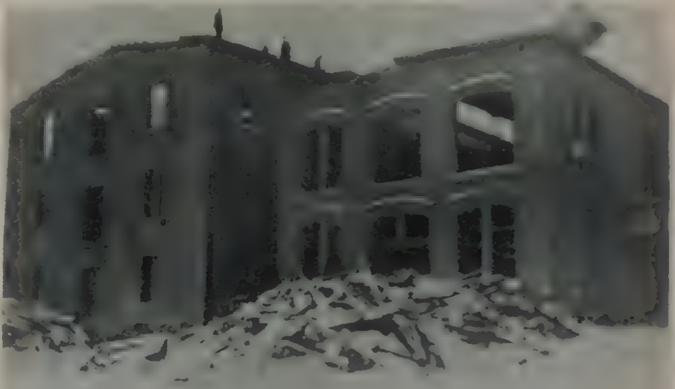
Mr. L. E. Dowling, construction engineer, Toronto, who has been handling work for this company in Monteral, was sent for by them on Dec. 15 to superintend the restoration of the plant and on the same day set out for Halifax. The conditions which had to be contended with were the most trying. It was at first found impossible to obtain either labor or materials, as the entire population, who were uninjured, were working day and night in looking after the housing of those who were left destitute by the destruction of their homes and all available material was being used for the same purpose. The authorities took the stand that the rate paid for both labor and material should not be greater than the union rate prevailing in Halifax at that time. This made the employment of outside labor extremely difficult as their rate was 25 cents an hour for common labour and 40 cents for carpenters, which was much lower than that paid in other cities. Indeed, under the circumstances, it was impossible to induce men to come to Halifax to help in the reconstruction of the plant. On pointing out the difficulties of the situation, however, to the authorities they removed the restriction and permission was given to pay whatever rates were considered necessary, but it was stipulated that anyone employing outside labor which he had not himself imported, must first have a written statement from the original employer to the effect that the deal was satisfactory to him. In this way, the stealing of labor, for which another employer had been at the expense of railroad fares, was prevented.

It was necessary to erect buildings to accommodate the workmen as no board was available in the city or vicinity. A building 35 x 60 feet, was put up on the grounds of the company and equipped throughout with the necessary furnishings. Two of the least badly damaged buildings in connection with the plant were also put into shape and used for the same purpose. In order to carry out this work, carpenters had to be brought in from Toronto and kept at one of the city hotels till its completion. The material used in the building was secured from the wreckage of the plant.

Owing to the congestion of the government lines, difficulty was experienced in getting any materials from outside points, but after a lapse of about three weeks, supplies, mostly obtained from Campbellton, began to come in slowly and the work of reconstruction was commenced.

The plant consisted of the following buildings: Office building, 30 x 83 ft.; garage, 22 x 52; twine mill, 90 x 273; boiler house, 50 x 70; machine shop, 60 x 90, two storeys; rope walk, 28 x 1,030; jute mill, 100 ft. square; tar house, 28 x 93; engine house 25 x 60; picker house, 40 x 52; hemp store, 50 x 520; rope store, 50 x 300; yarn store, 30 x 60; manager's bungalow, 45 x 62; twister room, 32 x 280. Of these, the office, garage, tar house, picker house, hemp store, manager's bungalow and yarn store have to be completely rebuilt while it was found posible to repair the remainder.

Owing to the weather having turned very cold immediately after the disaster, all the water pipes of the heating and sprinkler systems were frozen and burst, no attention having been paid to them as the organization was more or less upset. As a result the entire systems had to be renewed, the old material being sold as scrap.



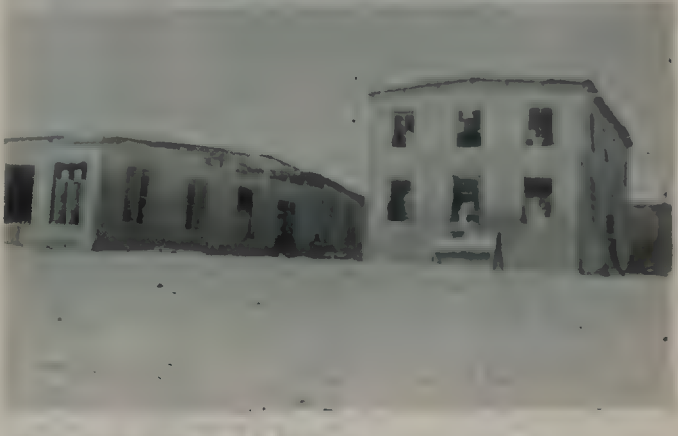


Fig.1—Machine Shop and Boiler House
Fig. 2—East End of Twine Factory, and Picker House—The Picker House though seeming little damaged at first sight, had to be completely rebuilt.

Explosion Had Some Peculiar Effects.

The manner in which the damage to the buildings appears mainly to have been caused was by the lifting up of the roof by the inrush of air and its dropping down again on the walls, driving them out or smashing them. Owing to the timbers being mortised and tendoned, they of course remained out of place after the first dislocation. Some peculiar circumstances were noted in connection with the damage to the buildings. In the rope walk, a narrow building, 1030 ft long, the roof of which had split at the angle of the rafters and dropped into place again, every second post had been knocked out, while the balance remained standing. The same peculiar feature was noted in connection with the foundation piers of the twine mill. In the rope walk the rafters on the north side were split, while those on the south side were intact. In the machine shop, illustrated in Fig. 1, the weight of the roof, as it dropped back, damaged the upper storey to such an extent that it had to be removed, the brick being used for the construction of a new office building. As the space was not urgently required, a new roof was placed on the lower storey of the former building. The boiler house, which adjoins the machine shop, had three walls practically intact, while the fourth, close to and sheltered by the machine shop, collapsed. The boilers stood the shock without injury, as did also the 150-foot smoke stack.

Figs. 3 and 4—The Twine Factory and the Jute Factory—Two badly wrecked buildings which it was found possible to repair

The latter took a lean of 9 in. to the north, but otherwise is undamaged. In the manager's house, which was taken down and rebuilt, the timbers had the appearance of being in good shape, but on the removal of the plaster, all the studding was found to be split. This was undoubtedly the case in a great many houses in Halifax and the vicinity, though in numerous instances walls which had fallen were jacked back into position without the removal of the plaster to ascertain the condition of the studding. The picker house which is illustrated in Fig. 2, outwardly appeared to have sustained little inury, but on examination the timbers were found to be split and damaged to such an extent that the building had to be torn down and re-erected.

In many of the buildings, where walls had collapsed, it was frequently found possible to jack them back into position and use them again after some repairs. Owing to the difficulty of obtaining materials, the spiking and bracing of split timbers was resorted to, and in this way much material was saved, only $17,000 worth of new lumber being used in the whole work. In the case of the twine factory, illustrated in Fig. 3, five bays were blown out of the west side and seven off the east. These sections of the wall were jacked back into place and the roof repaired. The jute factory, which is shown in Fig. 4, was also put into shape by jacking back the walls which had collapsed, and putting on a new roof.

No Fatal Casualties

Badly as some buildings were wrecked, none of the employees were killed or seriously disabled, though there were 150 or 160 working in the plant at the time of the explosion. Some, however, lost eyes, and there were other injuries of a minor nature.

As mentioned above, Mr. Dowling and his superintendent, Mr. Williams, set out for Halifax on Dec. 15, and on March 27 the plant had been sufficiently restored to be put in operation again, while the whole undertaking was completed on July 25, despite the many difficulties under which work had to be carried out. Not the least of these was the weather, which became very cold and severe following the disaster. Heavy blizzards of snow impeded operations, necessitating constant shovelling, and the cold made it very unpleasant for the workmen on the job.

Compressed Gas Storage Tanks for Motor Vehicles

The war has developed the inventive genius of the nation to a wonderful extent. The war is also responsible for the gasoline, or petrol, shortage in England. This shortage was soon realized with the result that many minds were turned to the solution of the difficulty. Motor bus transport, which is one of the important means of transport in the cities of England, was placed in a difficut position by lack of fuel and those interested began to look for a substitute. The first innovation was the appearance on the streets of a motor bus with a duck gas container, secured to the top. This container resembled a small sausage balloon and had to be re-charged at frequent intervals. Notwithstanding the apparent drawbacks to this equipment, it was successfully used. Word now comes that the London Motor Bus Company have equipped their cars with steel cylinders to contain compressed gas. The busses with this equipment have been tried out and proclaimed to be satisfactory by the company. This is another instance of the ability of England to meet any emergency.

Easy Application of Wall Board

The rapidly increasing use of wallboard is indicated by the fact that special molding has been designed to use with this product and make its application easy. The wall board is held in place by means of a stop, so that it is not necessary to drive any nails thru the board itself. A considerable variation is thus allowed for, due to expansion and contraction, settling of the walls, etc., without buckling the board. This moulding allows satisfactory panel arrangement, eliminate the need of headers or nailing pieces, makes unnecessary the exact spacing of studding, and obviates trouble around doors and windows.

How Electrical Services Were Affected—Repair and Employment for Relief Work

The Explosion and the Telephone

By W. H. Hayes*

THE plant of the Maritime Telegraph & Telephone Company, Ltd., comparatively speaking, received little damage outside the area in the vicinity of the explosion, and otherwise was in full operation shortly after the explosion occurred.

All the buildings of the company were more or less damaged. The "Lorne" central office building most of all, it being in the north end of the city.

Local and Long Distance Lines Wrecked.

All the poles, cables, wires and telephones in the devastated area were of course almost wiped out of existence, and those that were not were so broken and tangled up with electric light and power wires, they were of no further use. The long-distance lines of the company passed right by the spot where the ill-fated boat exploded, and were on poles 35 to 40 feet in height, along with the wires of the Western Union Telegraph Company. A gap of one mile was blown in this line of poles.

The "St. Paul" central office building, located in the centre of the city, had the majority of its windows blown in, as also the Head Office builidng located near by., a number of the employees being more or less cut about the hands and face with flying glass. The "Harbor" central office building, located across the harbor in Dartmouth, had all its doors and windows blown in, but no one was hurt.

The company had just completed a fine new central office building on Sackville street, opposite the Citadel Hill, which they have since occupied as the "Sackville" central office, replacing the old "St. Paul" office. This new building had all the doors and windows blown, some out and others in. It had just been fitted up with the latest type of switchboard and would have been put into service two days later. While the explosion delayed the putting of it into service, it also forced the change to be made at the very first opportunity, owing to the congestion in the old office. The change was therefore made on the night of December 22nd, two weeks after the explosion. A staff of Northern Electric Company's men were at work in this building when the explosion occurred, finishing up the work of installing the new equipment, and some of them were very badly cut with the flying glass. A great deal of the glass in small particles got into the fine parts of the equipment, necessitating a great deal of tedious work to remove.

With the exception of two of the young lady operators, who were off duty at the time, and who were instantly killed at their homes, all the employees of the Company escaped serious injury and were soon at work again.

Switchboard Equipment Escapes Damage.

The fact that none of the equipment in the way of switchboards, etc., in the central offices sustained any damage, enabled the company to restore the service to most of the subscribers not in the devastated area, with very little delay. It is not likely there would have been any interruption whatever to the continuity of the service, except for the report circulated immediately after the explosion, that another explosion was imminent, and the order for every one to get out into the open. This caused every employee to flee for safety along with the rest of the population, leaving the switchboards to run themselves. This condition lasted for about one hour and a half, when word was sent around that all danger was passed. The operators and other employees then began returning to work in ones and twos until a full staff was on hand.

In the meantime the central office batteries had run down and required recharging. This could not be done until the power company turned on their current, which they were very loth to do owing to the possibility of starting fires through damaged wiring. However, after consulation with the City Electrician, Mr. Colpitt, it was decided to take the risk. Fortunately it caused no further damage and the switchboards were soon in full operation in the "St. Paul" office, but the "Lorne" office being in the area cut off by the explosion, it was two days before current could be turned on to charge the batteries in that office. Luckily the batteries had sufficient life to carry the load until the current was available.

In the "Harbor" office the battery charging current is supplied from Halifax by submarine cable across the harbour; this cable had been damaged and no current was available there. This was overcome temporarily by the installation of a complete gas engine and motor in one unit, which did the work until the current from the usual source could be supplied.

The first thing required was to get the openings in the different buildings closed up before night set in. quick and intelligent work on behalf of the staff this was fairly well accomplished.

Telephone Connection with Dartmouth Severed.

The telephone connection between Halifax and Dartmouth is maintained by means of submarine cables carrying 100 wires. These cables were found to be working immediately after the explosion but not for long; they had been damaged but not enough to cut them off entirely. However the storms that came up right after completed the work, and the service was cut off between the two places. It was impossible to stop out on the harbour in order to take the cables up to make repairs, or to lay new cables, owing to the severity of the storm, which raged day after day. Consequently before the weather moderated a number of ships had been blown up and down the harbour, dragging their anchors to such an extent that they caught in the cables, and twisted and shifted them about so that they were completely ruined and unfit for further use. Fortunately a new 100 wires cable was already in stock and as soon as it was possible to do so this was laid across the harbour, but a week or ten days had elapsed during which time Halifax and Dartmouth were telephonically severed.

After getting the operating force at the switchboards and the opening in the buildings closed up temporarily, attention was next turned to getting the Long Distance Lines in working order. It was impossible to rebuild the blown away part of the pole line owing to the fires which were raging and the rescue work going on, even if the help and material had been available, which it was not. Some other means had to be found to bridge the gap and that without delay. This was done by connecting all the Long Distance lines, where they pass through Rockingham, about three miles north of the centre of the City, on to the local suburban lines running in that direction, which enter the City via a different route to that of the Long Distance lines, and which were not damaged by the explosion. This temporary arrangement enabled the Company to place its main Long Distance lines into service the next day after the explosion, the superimpose on one of them a telegraph circuit through to Boston for the Associated Press service, which carried the first full account of the disaster to the outside world.

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*Assistant Manager, Maritime Telegraph and Telephone Co.

A piece of iron from off the doomed boat, weighing about 25 lbs., came crashing through the roof of the "Lorne" central office building and landed about two feet from the operators, embedding itself in the floor. It just escaped the switchboards by about two inches. This building at first sight appeared to be a total wreck; all the windows gone and many of the doors; the back part of the building being broken away from the front part, and daylight could be seen through the walls in many places. Bits of boards, canvas, cotton and every conceivable thing that could be got were used to close up these openings. Even the window blinds were torn down, those that had not been blown down, and used for this purpose. When the blizzard came the next day the staff suffered considerably from lack of heat. It was impossible to keep the building warm with the regular heating apparatus owing to the drafts blowing through in every direction. Temporary stoves were obtained as quickly as possible, and more permanent repairs were made speedily. Only in this way was it possible to get along and keep the staff at work.

Extent of Damage.

The number of telephones lost and destroyed were between 800 and 900, and all in the devastated area. The total direct cost of the damage to the Company will be about $65,000. The indirect cost, that is, the expenditures the Company will be compelled to make owing to changes being forced upon them on account of the explosion, will probably be over one hundred thousand dollars alone.

The outstanding feature of the work was the loyal self-sacrificing work of the operators at the switchboards and the repairmen who had to face the awful weather and keep it up day and night. The operators were at the switchboards continually, their meals were brought in to them, and at first it was necessary to supply them with sleeping accommodations. Owing to the severe weather conditions, and no street cars in operation it was necessary to convey the staff of about 80 operators to and from their homes or places of refuge. This work of course had to be performed by the men of the staff, with motors, sleighs or any form of conveyance possible to obtain that would answer the purpose.

The extra demand on the service was enormous; the Relief Committee, the temporary hospitals, Railway and others all wanted additional and special service to assist them in their humane work of helping to relieve the suffering. Lines had to be built, telephones installed, and also a number of private switchboards were wanted to properly take care of the vast amount of calling. Hundreds of people did nothing else all day long but sit with the telephone in hand calling and receiving calls, and when necessary to leave others took their place and thus kept it going. It was all supplied and the service rendered as well as it was humanly possible to do so.

Electrical Installation and Repairs

HALIFAX in pre-war days could never be called a well lighted city, although some attempts had been made to introduce modern lighting into the business districts, but with war regulations in force street lighting was greatly curtailed, and aside from a stray arc lamp and the light from show windows, streets were dark. The explosion of December 6th finished the street lighting, as practically every window in the city was destroyed, and consequently all store doors and windows were boarded up and the meagre light from these sources cut off. The explosion badly damaged the light and power lines of the Nova Scotia Tramway Company, and they were practically wiped out in the devastated area, although in those districts of the city where their poles were left standing, they made very quick recovery, and with emergency gangs accomplished wonders in a very short time in the matter of restoring these services.

Naturally all repair work was sadly handicapped by the necessity of workmen having to look after their missing relatives and friends, getting the injured to hospitals and providing some protection for their families and many of the Tramway Company's employees, including foreman and inspectors, were either killed or injured. The blizzard of Dec. 7th and succeeding days tied up all transportation and held up repair work on the lines, as well as causing additional serious damage; street car traffic was utterly demoralized for days and the task of getting the roadways clear and the lines in working order was herculean.

Darkness Hampers Relief and Repair Work.

The lack of light in the north end of the city was a great drawback to those engaged in rescue work, and the available supply of Daylos was quickly in use. Many of the automobiles engaged in this work carried a supply of candles for the use of householders who were without light of any description, and those trying in the darkness to effect temporary repairs to their homes.

After the urgent rescue work had been attended to, the first great rush, as far as the electrical houses were concerned, was the supplying of lamps and effecting necessary repairs to the equipment in the hospitals, shelters, bakeries, groceries and household furnishing stores;followed by the equipping of churches, basements, schools and any available place, as temporary homes for hundreds of families. With the rush of hospital, relief and repair parties to the city, it was necessary to equip any vacant buildings which were suitable, as camps, bunkhouses and dining rooms and the available electrical workers in the city were far from sufficient to look after this necessary work, and many were brought in from outside places, Montreal and Quebec supplying the major portion.

As soon as the relief work was thoroughly organized and put on a permanent working basis, the matter of erecting temporary homes for several hundred families was taken up energetically and, approximately, a thousand flats have been erected and furnished in a very comfortable manner for the use of those who lost their homes, until such time as the damaged houses have been made habitable, or new ones erected. The damage done to the interior of the houses throughout the city and which externally appeared to be in good condition has been enormous and the plaster in a large percentage in the houses in the city has fallen, or has been damaged to such an extent as to make its removal necessary. This necessitates a very great deal of electrical repair work, especially in the older houses where the installations are far from modern, and the city inspector now insists that wherever it is necessary to remove the plaster, all electrical installations be made perfectly modern and up to a standard that will comply with the latest regulations of the Board of Fire Underwriters.

There are many hundreds of jobs of this nature to be done in the city, as well as the installations in the new modern and hydrostone houses being erected by the commission. A great deal of electrical work is being called for in connection with new buildings being erected by the Military and Naval authorities and by the Railway, in sheds, docks, passenger station and car cleaning plant, and a very great deal of work in buildings being erected or enlarged for commercial purposes and in connection with the enlarging of the dry dock and the erecting and equipping of the plant of the Halifax Shipbuilding Company. There is not sufficient electrical labor to handle this work and great delays are being occasioned thereby. There are splendid opportunities at the present time for a large number of competent wiremen and linemen and splendid wages with abundant opportunity for working all the overtime they desire at inflated rates.

Fire Alarm and Lighting Services

THE explosion resulted in serious damage to the fire alarm and the lighting systems of the city. The former was put completely out of commission. The storage battery, which supplied its energy was thrown from the racks to the floor by the concussion, and the circuits were all broken down, in many places in the city. In the devastated area signal boxes were all destroyed, some of them being carried over 100 yards from their original positions. The immediate difficulty was to establish a service of some character, and in order to do this it was necessary to have current. Fortunately Dalhousie College had a set of batteries of a type used for this purpose, and Mr. P. R. Colpitt, the city electrician, was able to borrow it. There being no means of direct communication with places outside the city an order was placed, within an hour from the time of the explosion, with the Northern Electric Co. for new equipment. The company took energetic action, and immediately sent to the nearest point out of the city where it was possible to get in communication with outside wires in order to rush the order through. With the help of Dalhousie College and of some Northern Electric men who happened to be in the city, the city electrician was able to get a part of the system in working order the second day after the explosion. The greater part of the system however, had to be carefully gone over, as, due to concussion, many boxes were out of adjustment and could not respond quickly to the alarm.

The electric lighting service was completely demoralized, but after patrolling the business section of the city, energy was turned into the lines in the afternoon of the day of the explosion. The light service in the devastated area was entirely destroyed, the poles, (which carry the lighting and street railway wires)—being broken, and the wires thrown down, incluinding the portion of the high tension line serving the town of Dartmouth. Pending the new lay-out of this part of the city by the Relief Commission, nothing has been done towards reinstalling the lines. The plans of the Commission are to establish an underground service in the district referred to, with ornamental poles for street lighting. The city is negotiating with the Halifax Power Co. with a view to the street lighting being undertaken by that company, with energy from a water power on the North East River, 18 miles from Halifax. If these negotiations are completed the city will be equipped with about 1,000 lamps, consisting of luminous arcs and nitrogen incandescent lamps of different capacities, the large ones for the business section and the small ones for the residential districts. The present system consists of a series of enclosed arc lamps.

The outside wiring situation throughout the province has been put under the charge of the Provincial Public Utilities Commission, which is preparing a set of rules to be shortly issued to all companies. This will result in the line work being greatly improved and standardized throughout the province, where climatic and other conditions are exceptionally severe.

Concrete for Skirtings

It is suggested that cement should be employed for skirting in place of the ordinary wooden skirting, not only for hygienic reasons, but because it is less liable to damage from the movements of furniture, &c. Cement skirting has no corners or angles to harbour or collect dust and dirt, and is therefore more easily kept clean. It is a scheap as wood, and having regard to the fact that it is less liable to damage than wood, it suggests itself as particlarly sunitable for hospitals, sanatoria, and other municipal institutions.

A water tower in Tillsonburg, Ont., and a public bath in Montreal have been destroyed by fire, the loss in each case being in the neighborhood of $50,000. The destruction of the water tower has left the residents of Tillsonburg without water for domestic or lawn service. The fire feind has had the laugh on Canadians for many years, but surely he has never shown himself more disdainfully triumphant than in attacking the very strongholds of his direst foe.

The Toronto Civic Property Committee recently adopted the recommendation of a sub-committee that an effort be made to take advantage of the provincial government's offer to loan money for building purposes at a low rate of interest to municipalities; that the Toronto Housing Company be asked to offer suggestion and to co-operate and that city owned land be utilized. The further recommendation was also made that the governemnt be asked to modify its offer so that people owning their own land may secure a loan not to exceed $2,500 by giving a first mortgage to the government secured by a guarantee of the city.

The Furness, Withy Company Reinforced Concrete Pier at Halifax, N.S.

By A. F Dyer, C.E.

OWING to the collapse of portion of their timber pile wharf in the spring of 1915 the Furness-Withy Steamship Company decided to remove the whole of the timber pier and replace it by a permanent concrete structure. With this end in view they called in the Nova Scotia Construction Company who had just completed a large reinforced concrete pier at Halifax for the Canadian Government Railways, to submit designs and proposals. Plans were preparade and a contract was entered into with the above company in September, 1915, for the construction of a reinforced concrete pier 590 feet in length by 90 feet wide, carrying a single storey shed 514 feet by 70 feet, and the work immediately started.

The type of construction chosen was that of a reinforced concrete floor supported on steel cylinders sunk to rock and filled with concrete, the shore end of the floor being carried on a gravity section concrete retaining wall.

The first operation was to remove the old timber pier. This pier had been built about sixteen years previous and it had been built over a former smaller wharf. The sixteen year old spruce and hemlock piles, although in places badly attacked by limnoria, were, on the average, in fair condition and easily pulled, but the piles of the older wharf were mere stumps which gave more trouble.

As the water under the shore end of the old pier was found to be very shallow dredging had to be carried out in order to obtain a depth of ten feet at low water to provide sufficient water for the floating plant. This dredging was done by means of a 1½ cubic yard "orange peel" bucket. Over two hundred pile stumps were pulled by this dredge.

The bulkhead wall of the old pier consisted of a heavy dry stone wall built on timber cribwork. As the deck level of the new pier was to be six feet above the top of this stonework it was found necessary to discard this old wall and to build a new wall which would conform with the type of construction of the new pier. Rock bottom was found at a depth of about twelve feet below low water of spring tides and a gravity section concrete wall was put in. This wall was built in three sections, the excavation and concreting being carried out in the dry inside cofferdams made of a single line of U. S. steel sheet piling. The same piling was used for the three sections, being driven to refusal by a drop hammer weighing 1,800 lbs.

The cofferdams were rectanguar in shape about 40 feet by 14 feet and a 6-inch steam driven centrifugal pump was used for unwatering and keeping dry. Coal dust, fine cinders and sawdust were all used in order to stop leakage through the cofferdam, fine cinders being found to be the most satisfactory as well as being the cheapest.

The maximum head of water dealt with was about 21 feet, and the amount of leakage at this depth was remarkably little, no difficulty was found in stopping any leak which might develop between two sheet piles by simply throwing quantities of fine cinders down the outside of the piling, the rush of water carrying the cinders into the joint and thus stopping the leak. Some difficulty, however, was encountered in dealing with blows under the piling and as the excavation neared the rock a constant watch had to be kept to deal with any signs of blowing. The remedies were the further driving of the piles if possible and the heaping up of materials in bags and in the loose outside the danger spot.

On the completion of the three main sections of the wall the excavation and concreting of the two small closing sections were carried out in the wet, sheet piling being used to act as forms for the concrete below water level.

Not more than 5 per cent of the piles were damaged to any extent by being driven and used in the three cofferdams. The pulling of the piles was not a very difficult operation except in the few cases where the bottom ends of the piles had been bent and split by coming in contact with boulders. In these cases it was found necessary to pull groups of three or four piles at one time. Three sheeve blocks carried by the pile driver with the occasional use of a steel rail as a lever in starting a pile were used throughout for pulling the piles.

The face forms for the wall from low water level to 18 inches above high water level were of 4 in. hard pine planks securely spiked to vertical timbers embedded in the concrete and anchored with steel bolts. These forms have been left on the face of the wall to protect the concrete against frost action between tide levels.

The contract plans and specifications called for the driving of large reinforced concrete piles within the steel cylinders, which were then to be filled with concrete, except wherever the steel cylinders were sunk to bed rock in which cases the piles were to be omitted. The contractors decided that they would excavate to rock in every case and work was started, a "Harris excavator" being used for the excavation. This machine operated an "orange peel" bucket and was carried on a scow.

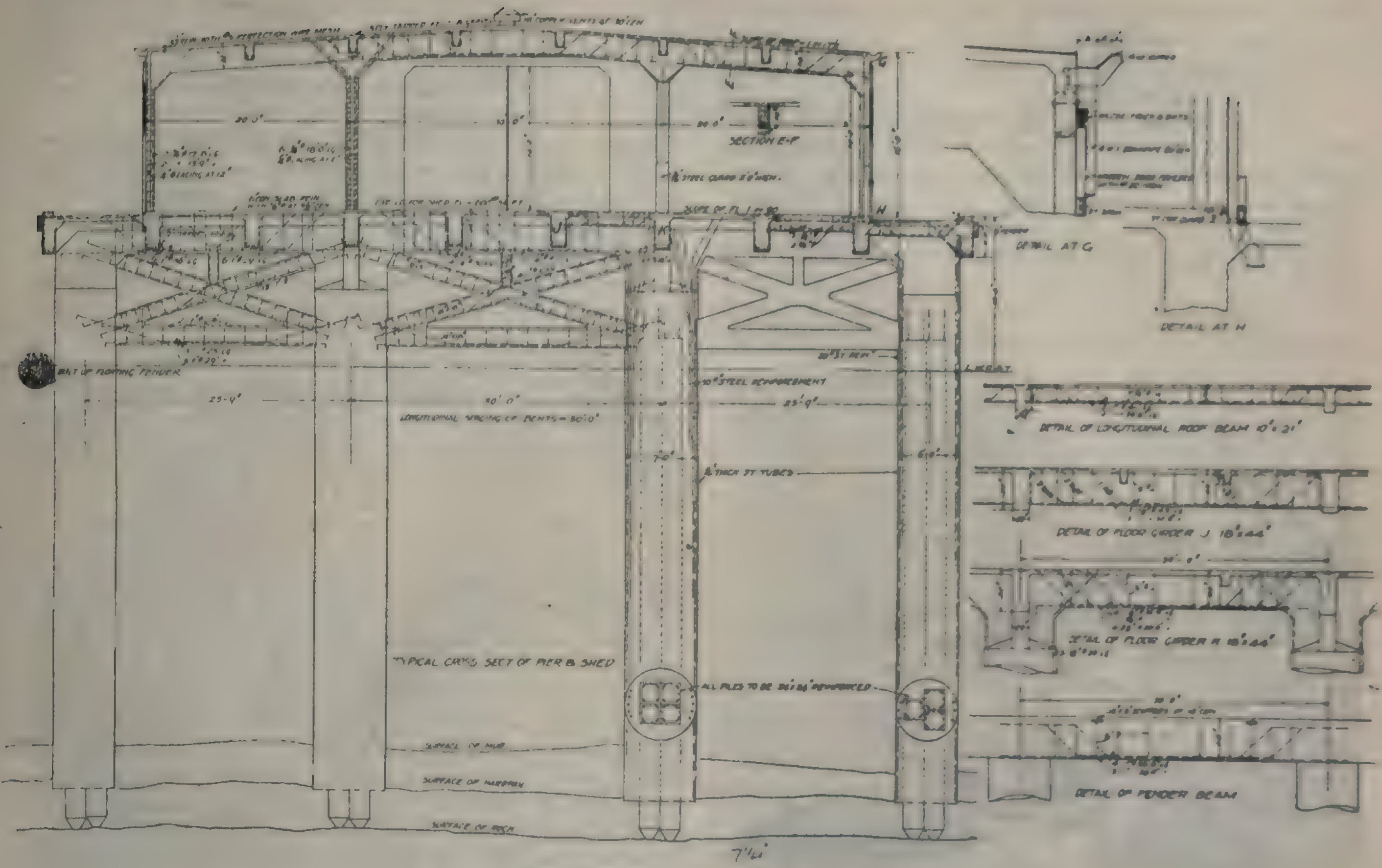
For about two hundred feet out from the bulkhead considerable trouble was met with in this excavation owing to the presence of an old timber crib which was found sunk in the mud and also to the very tough nature of the boulder clay which overlay the rock and resource had to be made to dynamite.

Three holes for the smaller cylinders and four holes for the larger ones were sunk to the rock and loaded with cartridges 2 in. in diameter and 30 in. long, filled with 60 per cent "Forcite". In some cases where the depth of clay was great a second set of holes had to be blown before the rock could be laid bare.

Towards the outer end of the pier no clay was met with, there being only considerable silt and stone filling overlying the rock.

The plans called for four cylinders per bent, the two outside ones being six feet in diameter and the two interior ones seven feet. The bents are spaced 30 ft. 3in. apart, and the four cylinders are spaced 25 ft. 9 in., 30 ft. 0 in. and 25 ft. 9 in. centre to centre.

The cylinders are made up with ¼ in. steel plates having rivetted lap joints. These were fabricated by



Showing End Section, Furness, Withy Pier, Halifax, N.S.

the Maritime Bridge Company of New Glasgow, N. S., and were shipped on cars to Halifax ready for use. The lengths of the cylinders were determined by probings to rock and, as a rule, worked out very well.

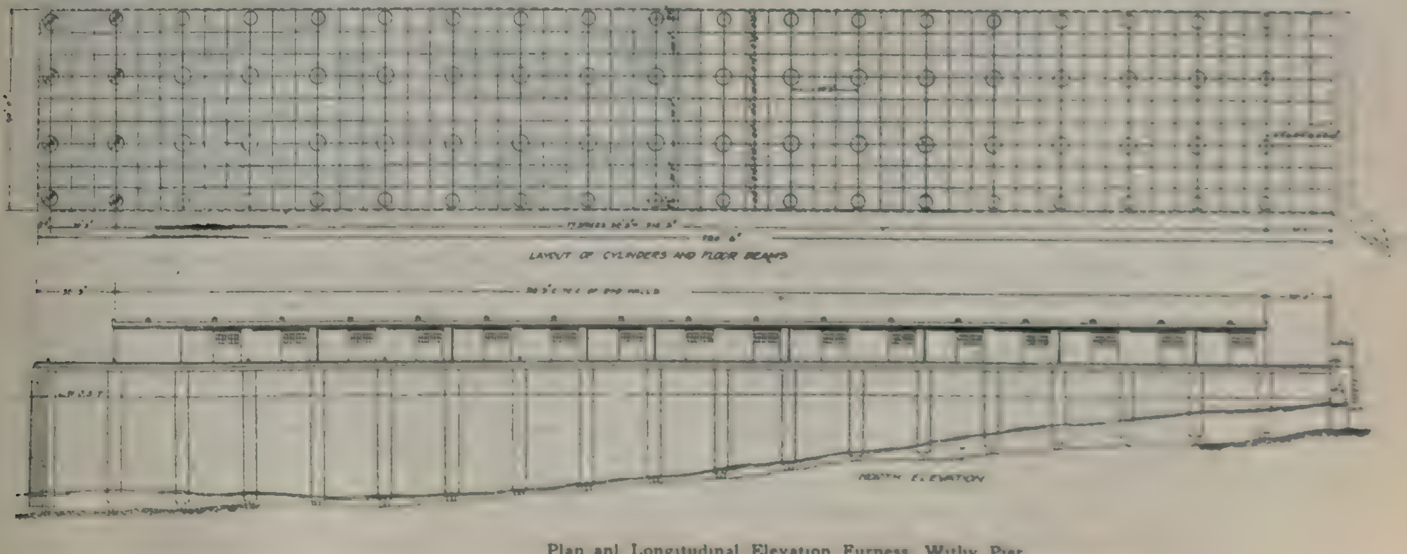
The contractors for the pier unloaded the cylinders from the cars on to a scow, which conveyed them to the site of the work.

The foundations for a bent of cylinders having been excavated to the rock, guiding timbers fastened to the pier falsework were set so as to hold the cylinders in correct position when being set. The cylinders, as required, were then tipped endwise into the water and raised into a vertical position by a floating derrick which set each in its location as marked by the timber frames.

A helmet diver was then sent down each cylinder to thoroughly scrape and clean the foundation and also to close up any apertures which might exist around the bottom edge of the cylinder.

The setting of the cylinders was found to be a comparatively easy piece of work. In fine weather, when there was little wind, the four cylinders of one bent could be set and secured in about eight hours.

Owing to the distance of 30 ft. 3 in. between the bents of cylinders it was necessary to drive temporary wooden piles to support the formwork for the pier



Plan anl Longitudinal Elevation Furness, Withy Pier deck. Two rows of piles at ten feet centres were driven between each bent; these were capped with 10 in. x 10 in. timbers running parallel to the bents and braced with diagonal bracing.

After the setting of a bent of cylinders it was found advisable to drive one full row of piles outside of the newly set bent and a few of the piles at each end of the second row in order that the empty cylinders might be held securely in a vertical and correct position by bracing to the piles until they were filled with concrete.

The concrete used for cylinder filling was mixed in the proportions of 1 part cement, 2½ parts sand and 5 parts broken gravel, and it was deposited under water by a bottom dumping bucket which held one batch of 20 cubic feet. 1¼ in. square twisted rods were set vertically inside the cylinders as the concrete came up. These rods were placed towards the north and south sides of the cylinders and their tops extended up into the superstructure of the pier in order to stiffen the work against lateral shocks. 1⅛ in. square twisted rods were placed in a similar manner on the west and east sides of the two inside cylinders to give longitudinal stiffness. The number of reinforcing rods placed in each cylinder and their lengths varied with the length of the cylinder.

Furness, Withy Pier, Halifax, N.S.—Steel cylinder being upended from scow.

The concrete filling of the cylinders was brought up to two feet above the level of low water of spring tides in one operation. The laitance was then cleaned off and the necessary holes cut in the sides of the cylinders for the setting of the low water concrete braces.

These reinforced concrete braces consisted of two intersecting diagonal members 18 in. x 18 in. in section joined at their lower extremities by a horizontal member 18 in. x 24 in., and having a short vertical strut projecting upwards from the intersection of the diagonals. These were heavily reinforced with 1 in. and 1¼ in. square twisted bars, whose ends were bent and extended beyond the concrete to allow of their being thoroughly bonded into the cylinders and superstructure. Three braces were required in each bent, the centre one weighing about 14 tons and the outer ones 12 tons each. They were cast on shore and were well set and seasoned before being used.

The two centre cylinders of each bent were made of such lengths as to bring their tops to about the level of the underside of the braces and from that level to 7 ft. 6 in. above low water they were continued in timber in two thicknesses, the inner 1 in. being untreated spruce and the outer 2 in. of creosoted hardpine. The outside cylinders were carried up to 7-6 in. above low water in steel.

After the setting of the braces and the completion of the cylinders the concrete filling was brought up to the level of the underside of the deck girders.

All parts of the concrete braces below the level of 7 ft. 6 in. above low water are sheathed with 3 in. thickness of timber in two layers, the outer being creosoted hardpine, in order to protect the concrete against the deteriorating action of frost and ice.

The pier deck, of slab and beam construction, consists of a 6 in. concrete sab carried by floor beams, longtiudinal girders and transverse girders. The transverse girders, 20 in. x 50 in., extend from side to side of the pier across the tops of the cylinders and concrete braces. The longitudinal girders, 18 in. x 44 in., run from bent to bent at ten feet centres, and the floor beams, 9 in. x 18 in., running parallel with the transverse girders, divide the panels into ten feet squares. The reinforcement of the beams and girders, consisting of round and square twisted steel bars, is shown by the plans. The slab is reinforced in both directions with ⅜ in. round rods at 6 in. centres.

This arrangement of beams and girders lent itself well to the locating of the construction joints where these were least objectionable, which was midway between two bents. No longitudinal construction joints were allowed in the pouring of the pier deck, it being an unbroken rule that a complete strip, 30 ft-3 in. wide extending from side to side of the pier, had to be poured in one operation. Such a strip contained 140 cubic yards of concrete and was usually completed in less than nine hours.

The surface of the slab was graded, screeded and floated as the work proceeded, no top finish being allowed to be put on afterwards. This procedure insured a compact slab of at least the required thickness with no danger of horiontal joints between concrete and finish. The centre 15 feet of the pier floor was laid level and grooved to furnish foothold for horses, the remainder of the floor is laid with a grade of 1 in 90 to each side.

Furness, Withy Pier, Halifax, N.S.—Cylinders in position and filled to 2 ft. above low water, braces set and deck forms being built.

The shed is a reinforced concrete structure 70 feet wide by 514 feet long extending from Bent No. 2 to

Bent No. 19. The end and side walls are 6 in. thick with pilasters under girders. There are two interior columns, 14 in. in diameter, in each bent dividing the shed into 20 ft., 30 ft. and 20 ft. bays.

The height of the shed at the eaves is 16 feet rising to 18 feet along the centreline. The transverse girders are 12. in. x 30 in., the longitudinal beams 10 in x 21 in., and the roof slab is 3 ½ in. thick, reinforced with wire mesh.

The roof is waterprofed with a three-ply tarred felt pitch and gravel roofing, and is provided with sheet copper ventilators, gutter lining and flashing.

The doorways through the end walls are 18 feet wide by 14 feet high, and are provided with steel frame and plate sliding doors. The side doorways are 12 feet wide by 14 feet high at 30 ft.-3 in. centres, provided with metal-covered wooden doors. All doors are carried on Richard-Wilcox overhead doorhangers and tracks.

Offices for customs and shipping clerks are provided at the shore end of the shed, also a heated storeroom for perishable goods. The shed is lit throughout with electric light, all wires being enclosed in conduit. The heating of the offices and storeroom is done by hot water.

Furness, Withy Pier, Halifax, N.S.—Setting Concrete braces

A water supply for ships and fire is provided, the pipe being carried on top of the roof so that no damage can be done to the contents of the shed should a leak occur.

The main concreting plant used for the work was a one-yard Ransome concrete mixer mounted on a travelling tower. The tower travelled on tracks laid on the pier deck and was equipped with separate hoppers for stone and sand. It carried a loading derrick fitted with a ½ yard clamshell bucket for handling the stone and sand which were brought alongside the work on scows.

The concrete was discharged from the mixer into an elevator bucket which raised and emptied it into a hopper at the top of the tower. The concrete was then fed from the hopper into the chutes which carried it to the forms to be filled.

As the concrete of the pier deck acquired sufficient strength the tower was moved forward, the shed forms being built in its rear. The chutes could be moved so as to deposit the concrete either in front for the pier or in the rear for the shed.

The pier deck was designed for a live load of 600 lbs., per square foot, the beams and girders being designed as T beams with a maximum compressive stress in the concrete of 650 lbs. per sq. inch and a tensile stress of 16,000 lbs. per sq. inch in the steel. The roof of the shed was designed for a snow load of 30 lbs. per sq. foot.

The concrete of the pier deck and roof was mixed in the proportions of 1 part cement, 2 parts sand, and 4 parts broken gravel. All cement used was manufactured by the Canada Cement Company.

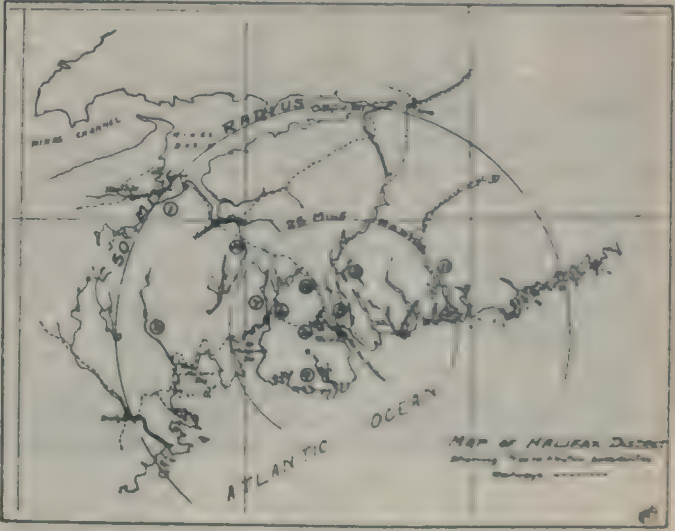
The work was carried out by the Nova Scotia Construction Company, Limited, under the superintendence of the Vice-President, Mr. Hamilton Lindsay, to whom the suggestion of the type of construction used is due. The details of the design were worked out by the writer, who acted as engineer in charge for the Furness-Withy Company during the construction.

Hydro-Electric Possibilities of the Halifax District

By G. E. Booker

IT will probably be of interest to those who know little of Nova Scotia, to learn that within a radius of fifty miles of the city of Halifax there are no fewer than eleven rivers and streams capable of developing a total of some seventeen thousand horse power.

None of the deevlopment are large, due to the comparatively small watersheds of the respective rivers: but owing to the rugged nature of the country, effective heads of from fifty to two hundred feet and over are obtainable. Up to the present time, however, practically no use has been made of this water power, in fact only one stream is developed to anything like capacity, and that is only equal to about three hundred horse-power. Although there have been a number of schemes drawn up within the last few years, nothing has up to the present materialized.



Hydro possibilities in vicinity of Halifax

The Halifax Power Co., Ltd., has the construction of its first unit on the North-east River under consideration, and hopes to have same completed at an early date.

The demand for cheap electrical power is one of vital importance to this locality, not only in the encouragment of new industries, but as a means of fuel conservation. The attached list of rivers and streams in the locality, together with the power capacity of each, is compiled from the Progress Report of the N. S. Water Power Commission, the activities of which body are under the efficient direction of Mr. K. H. Smith, resident engineer for the Dominion Water Power Branch.

Hydro-Electric Power.

Several of the smaller municipalities in the Province are also contemplating the development of hydro-electric power for lighting and power purposes, as the advanced cost of fuel has greatly increased the cost of operating the existing small steam plants. Unquestionably every stream which can be utilized for power purposes economically should be developed now; as it is only by thus making preparations for increased industrial activity after the close of hostilities that can we hope to be in a position to compete with our manufactures in the world's markets. In this connection it may be pointed out that Great Britain had up to the outbreak of the war only three small hydro-electric developments, aggregating only some three hundred and fifty horse-power. Since that time, however, developments capable of an output of about eleven thousand horse-power have been constructed by private parties; and further additions aggregating some seventy thousand horse-power are under consideration, as a means of obtaining cheap power for manufacturing purposes and of conserving fuel.

A bill dealing with the water-powers of Nova Scotia was passed during the last session of the Legislature which should in some degree assist in the economic development of these water-powers; and although it is doubtful whether an immediate market could be found for the total power available it can safely be stated that, with the promised industrial expansion of the locality, the demand for electrical energy will very rapidly outgrow the supply.

List of Power Possibilities of the Halifax District.

Ref. No.	Name of river.	Approx. distance from Halifax.	H. P. available at turbine shaft.
1.	Gasperaux	50 miles	7,437.
2.	Gold	45 miles	3,084.
3.	Fall	11 miles	564.
4.	Kerney Lakes	7 miles	313.
5.	Dartmouth Lakes	3 miles	158.
6.	Northeast	16 miles	4,209.
7.	Indian	16 miles	4,209.
8.	Pennant	12 miles	264
9.	Sackville	16 miles	947.
10.	St. Croix	30 miles	no data.
11.	Musquodoboit	25 miles	no data.

Halifax Ocean Terminals as a Commercial and Economic Proposition

By G. A. McLeod*

THESE Halifax ocean terminals were protected by the government for the purpose of providing adequate terminal facilities for the Intercolonial division of the C. G. R. at the same time providing the port of Halifax with modern shipping facilities second to none, having regard to the volume of business expected to find its way through this, the most desirable harbor on Canada's Atlantic seaboard.

The many advantages bestowed by nature on Halifax harbor are so widely known that they need not be discussed, but it may be well to point out, brifly, those features which will arise, naturally, before the practical mind, especially were that mind called upon to consider Halifax in the light of a prospective field of commercial enterprise, and more particularly were that enterprise closely connected with trans-Atlantic traffic.

The most cursory examination of a chart of Halifax harbour will reveal the splendid natural protection of shipping, and the abundant area available for anchorage. More careful examination will reveal the ease with which the entrance and approach can be navigated, and the ample depth of water to be found throughout the whole harbour. This also applies to Bedford Basin, where may be found safe anchorage for almost the shipping of the world, and which has sprung into considerable prominence during the past year as an examination station. An examination of the map will call immediate attention to the extremely favorable geographical location of Halifax since it is many miles nearer to Liverpool, England, than New York, Boston, St. John, or Quebec. The railway connections to the interior, always very efficient and convenient have not been overlooked but have lately been improved by a new trunk line built by the Canadian Government over the shortest possible route from Moncton to Quebec, and from there to Winnipeg. Last, but by no means least, statistics record two very comforting and important facts, first, that Halifax harbor is navigable twelve months in the year, and second that the rise and fall of tide is only six feet.

When it was decided to develop at Halifax ocean terminals worthy of the name, and worthy of a port destined and which, thus equipped, was the sooner to become the chief Atlantic seaport of Canada, arrangements were made whereby the most thorough investigations were carried out to determine the best plan or layout for these terminals, and with the work of these investigations went hand in hand the consideration of the best design for their construction. Having decided that the general plan and the design for construction were to be of the best, great care was taken that the location should be the most suitable of those available. Some planning had been done, and one Pier was under construction, for a system of terminals at what is known as the "I. C. R. Deepwater terminals," but those in charge of planning the new and greater terminals, came to the conclusion that the "Deepwater" location, was too cramped for an expanding trade, and passed it by in selecting their site. They could have chosen the Dartmouth or eastern shore of the harbour, Bedford Basin, the old Deepwater terminals site, or along the western shore of the harbor in the southern part of the city of Halifax. The latter site was finally decided upon for various reasons. It faced upon a large open basin in which ships of the largest size could navigate or find anchorage. It was so formed that harbour bottom sloped off into deep water at an easy angle, providing a splendid opportunity to construct the works on good foundations with a minimum of costly deep water work, and with a very reasonable amount of dredging for slips or basins, and yet deepening rapidly enough that at the outer boundaries of the proposed quays, would be found at most points at least the depth of water required. The site also, owing to its proximity to the harbour entrance, will contribute in operation to the economical side, in that considerable time should be saved to large as well as other vessels calling at the port, and towage charges will be reduced to a minimum. In general the chosen site offered the greatest hope of attaining to perfection in efficiency as well as holding its own from an economical standpoint.

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*Comptroller Foley Bros.. Welsh, Stewart and Farquier.

North Wall, Basin No. 1

In the general plan or layout of the new terminals there has been practically no criticism. Starting at the southern boundary of the Dominion Coal Company's and Halifax Electric Company's properties a solid bulkhead wall extending nearly north and south, and practically parallel to the channel or fairway of the harbour, was built for a distance of 2,000 feet. Near the Northern end of this wall will be erected a passenger station fully in keeping with the standards established in other parts of the works. It will have, of course, at its eastern side which opens upon the bulkhead wall, means of embarking and debarking the passengers of ocean steamships. Passing through this eastern entrance incoming travellers will find themselves in capacious waiting rooms, opening upon the train concourse on the south side leading to the city streets on the floor of the building or into corridors west side. Along the north side will be mail, baggage and express, receiving and delivery rooms. Along the bulkhead quay south of the station will be provided baggage inspection and storage space, immigration department accommodation, and other facilities for the reception or despatch of travellers and their effects. At the southern extremity of the bulkhead passenger quay and at right angles to it there will be basin or slip No. 1, which will be three hundred and sixty feet wide at its entrance. On its north side it provides two berths, one 700 feet long and the other 500 feet, the north quay wall of this basin being curved slightly toward the south between these two berths, so as to provide sufficient width, at the western or shore end of this basin, for the railway tracks to the train concourse of the station. At the 700 feet berth 35 feet of water at low tide will be provided while at the 500 ft. berth there will be 30 feet of water at low tide. At the south side of this basin, the quay wall, which serves at once as the south quay of the basin and the north quay of the first pier, will be 1250 feet long at right angles to the bulkhead passenger quay. The pier will be 320 feet wide at its outer or eastern end, and 360 feet wide at its base. It will be equipped with entirely modern transit sheds, freight handling appliances, and efficient arangements for the quick despatch of freight cars to and from the pier. To the south of this pier will be the second basin or slip, which will be similar to the first basin, with the exception that neither of its sides or quays will be curved as was the north quay of basin No. 1, but instead both quays will be straight and of the full length of 1250 feet. This basin will be 360 feet wide at its entrance and 320 feet wide at its inner end. The south quay of this basin forms the north quay of the second basin the whole comprehensive scheme of the new terminals calls for four more piers, and four more basins of exactly the same dimensions and properties as the first pier and the second basin adjoining it. In front of the bulkhead passenger quay and at all the quays with the exception of those two shorter berths, at the north quay of basin No. 1 specilly described hereinbefore, the depth of water to be provided will be 45 feet at low tide.

Outer End Pier A—Area between walls yet to be filled in

What was true of the general plan of the terminals has also proved to be true of the design of construction decided upon. Not only has there been practically no criticism offered to it, but from eminent engineers and construction men who have studied it in theory and observed it in practice, have come expressions of complete confidence in its ability to do what its designers claimed for it, which was to produce terminals imposing and pleasing to the eye, economical to construct, and of a degree of stability to withstand any usage to which they are likely to be subjected. The quay walls are to rest upon three classes of foundations. First, on solid rock dredged to the depth required for the berths, second, over areas where solid rock is found between 45 feet and 55 feet below low tide, and third where solid rock or bottom is found at a greater depth than 55 feet below low tide. Where the first class applies the rock is dredged to at least the depth required and concrete pedestals are prepared at exactly the level required, upon which the quay walls are built. Where the second class applies mass concrete is placed under water to bring the foundation level up to a depth of 45 feet below low tide, at which level the quay walls rest upon it. Where the third class applies a mound or base of rubble rock is placed to bring the foundation level up to a depth of 45 feet below low tide, at which elevation the mound is prepared with concrete pedestals to receive the quay walls. The quay walls are formed of reinforced concrete blocks so made that uniform openings in the blocks fit exactly one above another when the blocks are placed in the wall. The blocks are 31 feet long, 22 feet wide and 4 feet high, and are set in the water, one on top of another in stacks and one stack in front of another so as to form a wall 31 feet wide and as long as may be necessary. Provision is made by square concrete posts to key one stack to another, and when all blocks are in place the openings just referred to are filled, some with concrete and some with rubble rock, the whole thus being welded into a solid wall. The blocks of the size just described are used to construct the quay walls to the level of one foot below low tide, when two blocks, each 8 feet shorter than the lower ones, are used as the two top blocks of each stack, placed at the inside of the wall. This provides at one foot below low tide a ledge 8 feet wide on which is constructed a facing of dressed granite to a height of 16 feet. This facing is smooth, straight and even on the outside, but is made up of alternate headers and stretchers, leaving the back rough and irregular, providing a splendid artificial bond for a heavy backing wall of concrete which is poured in behind the granite, bonding into it and also into the openings in the concrete blocks. Behind the concrete backing of the granite, the areas and quay spaces are raised and reclaimed to the same level as the top of the granite wall, with ordinary filling, through which will be driven concrete or other piles, for the foundations of the terminal buildings.

Key Wall, Pier A, Basin No. 2

A little study of this design will impress upon any one the fact that stability, economy and appearance are all admirably interwoven within its provisions. The reinforced concrete blocks, bonded together, backed up by solid filling, and protected over their entire exposed surface by a wall of the proverbial granite, will surely provide quays of undoubted strength and fully capable of performing the functions expected of them. The granite walls, all of carefully dressed blocks and well and truly laid, will certainly answer the demand of the citizens, aesthetic and otherwise, that the outward appearance shall not be in default, besides performing the important practical function of withstanding the actions of frost and other elements between high and low tide levels, and the contact of ships or fenders.

There is no doubt that the layout of the new terminals is complete and convenient, that the design for construction briefly described possesses sufficient merit, and that the many advantages of the chosen site warrant the expenditure necessary, for a railway branch four miles in length, to connect the new terminals with the main line tracks of the Canadian Government Railways, but one cannot turn a deaf ear to misgivings expressed by some, indeed by a number as to the safety of ships lying at these terminals in bad weather. It has been said that there is a menace in the undertows in the vicinity of the new terminals, and that the gales from the south-east in the fall and winter will spell failure for them. Some of this is honest criticism from conscientious thinkers, some the carping cry of the pessimists, and some the parrot-like superficial abuse of those who have not knowledge whereof they speak, and whose inspiration could undoubtedly in most cases be traced to partisan interest. The first point with regret, the second with alarm, and the third almost with pleasure and at least with the complacence of the "told you so," to the severe storm of December 15th, 1916, when some damage was done at the new terminals. The facts are that in mid-summer of 1916, the government decided to erect temporary sheds and provide three berths at the new terminals, for overseas shipments during the winter of 1916-17. To this end

North wall of Basin No. 1, showing freight shed in construction on passenger landing quay the contractors were forced to concentrate, night and day for seven days a week, all their resources, on the parts of the work vital to the accomplishment of this object. By December 1916 they had, as a result, pushed out the north quay of basin No. 1 to its full length, and the south quay of basin No. 1, or the north quay pier "A" about half its length, and had completed the dredging of basin No. 1 to the required depths. The result was that three berths were provided but the north quay of basin No. 1 stood out by itself several hundred feet beyond any other walls, thereby offering itself as a natural catchpit or breaker for heavy seas or under-tows from the south-east, and east. If the first pier had been completed this would not have been the case. The north quay of basin No. 1 would have been protected by a solid pier 320 to 360 feet wide and 1250 feet long only 360 feet distant. If the whole terminal scheme were completed each pier would be a protection to the basins adjacent till the southern limit of the scheme is reached where a heavy stone breakwater is under construction to protect the last pier or, indeed, the whole or any part of the terminals constructed.

Preparations were not even complete for these temporary berths when a few days before December 15th, 1916, two large steamers were sent to dock at the north quay of basin No. 1. The fenders intended to lie between ships and the granite wall were not ready, mooring hooks and posts were not placed and contractors floating plant which heretofore had been at home anywhere in the terminals area, had not been provided with other anchorage, when suddenly about midnight on December 15th the wind freshened to a gale from the south-east, accompanied by sleet and rain. The captains of the two steamers attempted to find fendering which should have been ready before any vessels were docked, and to find moorings which should also have been provided. They were only able to get a few of several temporary fenders then being constructed consisting of short hemlock timbers bound together with wires, which were intended to serve in ordinary usage till more permanent fenders were completed, and in the darkness were obliged to attach their moorings to anything that offered the least hope of resisting the strain of the heavy lines. The results obtained were not of the class usually described as satisfactory and to make matters worse the contractors were in the meantime endeavoring to safeguard their floating plant, following their usual custom of towing in scows, dredges and other like equipment, most of which owing to its employment in the vicinity of basin No. 1 was brought there by the tow boats. Before long a number of large scows were closely packed beside the ship at the inner end of the basin, and the seas being caught by the exposed quay, at the outer end, were flung along the quay into the basin with telling effect The captain of the ship in the outer berth by possibly more judicious distribution of such fendering as he was able to secure and unhampered by the flotilla of large scows which collected beside the other steamer, suffered practically no damage, but the ship in the inner berth was not so fortunate. Being less well supplied with moorings, with no adequate fendering, and crowded by the contractor's floating plant one violent surge of the ship brought it in sharp contact with the granite wall of the quay, damaging several feet of the latter and denting several plates of the ship. One of the contractor's tow boats which became wedged in amongst the scows and others floating equipment in basin No. 1 was lifted by a swell surging along the quay wall and came down striking her stern sharply on a partly constructed section of quay wall at the west end of basin No. 1, or upon a large steel scow whereupon she lifted and sank. A scow used for carrying sand and cement, which at the time was heavily loaded, also filled and sank near the tow boat. Some other minor damage was caused to the contractors' floating plant, but when it is pointed out that it consists of some 25 units and that only 2 towboats were in commission at the time the storm broke, one of which sank early in the night, it is really remarkable that the damage was so slight. But what the damage itself and its effects elsewhere? It was without doubt the most severe gale in many years, and it is very likely the equal of any that the port has ever experienced. There seems to be no doubt that a report in a local paper just after the gale that the velocity of the wind did not exceed 48 miles per hour is incorrect. This was indeed the record of the instrument at the Citadel weather bureau, but there is reason for believing that the instrument in use had not been in adustment for some time and a test was about

Roof at No. 4 pier nearly all destroyed by force of explosion

Concrete Backing and Granite on Key Walls that time, being considered. Other instruments in the harbour, however, which are undoubtedly read with care, and the records of which are considered an absolute necessity to an important department of the government, recorded the fact that the wind reached a velocity of 70 miles per hour early in the morning of December 16th, 1916.

At the new gas plant of the Halifax Electric Company a large concreting tower was blown down. At another wharf in the commercial district a large schooner was driven ashore till her bowsprit was driven through a warehouse many feet from the quay. Considerable damage was caused all along the water front and ships at anchor in Bedford Basin passed a very uncomfortable night. Considerable damage was caused throughout the city and the roof of one of the buildings at the provincial exhibition grounds was carried away. Telegraph and telephone service was demoralized to a greater extent than at any time in the experience of the then officials. Surely a gale such as this was an extraordinary event; one that men must face when it is upon them, but not one that is taken into the calculations of men any more than is fire or flood. The effects of it at the new terminals cannot, owing to their unfinished condition, be taken as a criterion of what to expect of them. Certainly they are faced by more open water than in some other parts of the harbour, but this feature, desirable at all other times, should not prove their doom because the possibility of a few unpleasant periods which at the most could only be of short duration. It should be borne in mind that the completed terminals will be provided with ample depth of water at the quays, will have capable fendering and will have abundant moorings of staunch design and construction. The time for decision of a suit at law comes when the cast has been completed and all the facts presented. The time for judgment of a building or any work of its kind is during its tenancy ,assuming correctness of design and capability of its constructors. Both of thes latter features being established with relation to the new terminals no reasonable mind would form its judgment of them, having only upon which to draw conclusions, the results of an emergent occupancy of a partly constructed part of those terminals.

Their true worth will only be known when they are in operation as a completed whole, and we dare to express complete confidence that these terminals will very quickly come into their own; that as a commercial enterprise they will be to Halifax and to Canadian trans-Atlantic traffic, what the Canadian Pacific Railway is to the west; that they will be held up as a tribute to the business sagacity of those responsible for them; that as terminals they will command the respect and confidence of all shipping men who become acquainted with them; that as one of the city's architectural and structural possessions they will command a place in the forefront; and that they will be a lasting tribute to their promoters, designers and builders.

On Aug. 15, the government took over the Stoney Creek road, in the county of Wentworth, Ont., as a provincial highway. The route of this road at the Hamilton end is changed, making it a continuation of Main street and connection with the present road at a point a short distance west of Fruitland. In this way a distance of five-eighths of a mile is saved between Hamilton and Stoney Creek.

Attractive Cement Buildings

In this day of high prices and scarcity of building material, contractors and builders have been eager to investigate any new article which promises to prove a satisfactory substitute for brick and lumber. Great progress has been made lately in the development of concrete products, and it is naturally expected that this field would eventually produce an article which would meet the approval of architects and engineers. Cement blocks made by various systems have been in use for years, but there are two or three defects in these products which cement workers have been endeavoring to eliminate. The most serious objection to the ordinary block is the fact that it will absorb water and therefore the result is a damp building. This is due to the fact that practically all blocks are made from the dry-mix and are either power or hand tamped. Concrete blocks must have sufficient water before the initial set of the cement to obtain the best results, and no matter how it is tamped or how much water is poured on afterward, the product will nevertheless be perforated with minute voids which allow the dampness to pentrate and detracts from the strength of the material. There is one other objection which is not so serious, but is nevertheless taken into consideration by contractors and builders. That is the fact that the blocks have not a very attractive appearance at any time. They remain wet for days after a rain, which is due to the fact that they absorb water, and in the spring the white efflorescence accumulates on the face, giving the block a blotchy appearance.

Cement workers have been endeavoring for years to perfect a system of manufacturing blocks from the poured concrete so as to eliminate the porousness and to obtain the full strength of cement used. One system in use at present which appears to meet the requirements, makes use of roller bearing iron trucks on which are mounted multiple moulds with collapsible cores. These trucks are placed under the mixer and the moulds filled with wet-mix concrete after which the load is wheeled into drying rooms.

The Canadian patents are owned and the machinery manufactured in Windsor, Ontario, by the Cast Stone Block and Machine Company, Limited. This firm also has patented a process of facing the block with crushed granite at a very low cost, giving the product the appearance of a high-priced article and at the same time a hard surface through which the moisture cannot penetrate. These blocks do not effloresce and retain their sparkling beauty in any climate. That this system has long passed the experimental stage is shown by the fact that plants are now being operated in Toronto, Hamilton, Montreal, Three Rivers, Edmonton, Winnipeg, Chester, N. S., and numerous other cities and towns in the Dominion. These blocks have the added advantage that they can be laid in the wall more radily and at less expense, it is claimed, than other similar products.

Housing War Workers

The United States Congress has just provided another $40,000,000 for the housing of war workers throughout the country. The department of Labor, which has charge of the housing problem has previously received an appropriation of $60,000,000. This will make a total of $100,000,000 for housing alone. Of this amount, $10,000,000 will be spent in the city of Washington.

Notes on Gravel Road Construction

IN the extensive use of gravel, defects in construction and maintenance have often resulted in an unsatisfactory road and have given rise to a demand for a more permanent surface. On the main highways this demand is justifiable, and a more permanent road surface must be used. Where the traffic is not in excess of 500 vehicles per day, a gravel road carefully constructed and maintained is the most economical and satisfactory possible. Professor H. E. Phelps of the University of Colorado outlined his ideas of the best practice in a recent article in his University Journal.

The first essential for any kind of surfacing is a well-graded and drained earth road, with no grades in excess of 6 or 7 per cent. if possible. The most vital factor in the construction of roads is proper drainage, for faulty or insufficient drainage is responsible for many of the repairs required on old gravel roads.

Gravel.

A good road-building gravel should be composed of hard and tough stones, the proportions of the different sizes being such that the voids will be a minimum, and should contain enough binding material to cement the whole mass together. For best practice, specifications should require 67 to 75 per cent of pebbles that will pass the 1½-in. screen and be retained on the ⅛-in. screen, with no pebbles longer than 1½ or 2 in. This often requires crushing larger stones and screening out excessive amounts of binder, refinements frequently neglected, to the detriment of the resulting road.

After the road has been graded and shoulders formed, the gravel should be applied. Two courses should be used for heavy traffic, and no course should exceed 6 in. deep of loose measure. The gravel after dumping upon the prepared subgrade should be spread to uniform thickness.

Spreading, Harrowing and Rolling.

Usually the gravel should be placed first on the end of the road nearest the supply, so that the teams will aid in packing. The gravel, after spreading, should be frequently harrowed, and if as much as 100 cu. yd. of gravel are hauled to the road each day one team should be continuously employed on the harrow. The importance of thorough harrowing can scarcely be overestimated, but it is nevertheless frequently omitted.

The gravel should then be well wetted, either by rains or by artificial means. Water can be hauled in carts or pumped through a temporary pipe line from some irrigation ditch or well. For good results it is essential that the gravel be harrowed, that it be wetted, and that it be then rolled. A power roller is best. The grader or drag will probably have to be used at times to preserve the crown, and the harrow should be kept running until the teeth refuse to penetrate the surface. Spreading the gravel dry to a thickness of a foot and leaving it for travel to compact, as is quite commonly done, will never give a good gravel road, especially in a dry climate, and is bad practice in any locality.

Maintenance of Gravel Roads.

To maintain a gravel road in a satisfactory condition it must have constant attention. With proper care in the early spring, followed by continued dragging after rains and the repair of little defects and holes, the surface can be maintained in a satisfactory condition and early resurfacing or reconstruction forestalled at a consequent saving in cost which will more than compensate the added cost of maintenance. The tendency is to largely neglect maintenance, on the theory that dragging a gravel road does no good, and that the patrol or continuous system of maintenance is too expensive. Dragging is often delayed until the road has dried after a rain, and then is not beneficial. A gravel road should be dragged during the first few months after completion following every rain, and afterward only after prolonged wet spells have softened the surface. Few attempts have been made to apply continuous maintenance, or to compute the cost of frequent reconstructions without continuous maintenance, so that the argument regarding the expense of such maintenance rests upon scanty facts.

Ten yards of gravel should be placed in neat piles every ½ mile along the road, to be used in patching holes. This work should be done while the road is wet. The hole should be first cleaned out, and then filled full, but no more, with well-compacted gravel, wetted down before being tamped into place. This patching should be as continuous as possible, and in dry weather may require sprinkling the road before patching it.

Frequent sprinkling of the surface of a gravel road in dry weather is probably too expensive for general use, even if done by motor-driven sprinklers. It would be advisable, however, to consider this method in some cases, as frequently a few days of dry, windy weather will result in so much daameg from heavy traffic that a gravel road will need resurfacing, a more expensive procedure than the sprinkling required to carry the road intact over this period.

Bituminous Surfacing

Bituminous surfacing is being tried out on the Lincoln Highway north of Denver, and has been the chief reliance in maintaining gravel roads in several states, notably Maine. An instance recently reported from that state shows that a gravel road 16 ft. wide can be maintained in good condition under a traffic of over 1,200 vehicles per day by an annual treatment of 4/10 gal. per square yard of Tarvia B, at a cost of approximately $850 per mile per year. This figure includes the wages of a patrolman, who works continually on the road except in the winter, and cares for from 6 to 8 miles of road. A patrolman is also provided on less heavily travelled roads that are maintained by patching and dragging. This amounts to $250 per mile per year, which may be taken as the minimum that should be provided for the maintenance of any gravel road.

As a result of large-scale trials on stored coal carried out at Illinois University it was observed that the portions of the pile in which fine sizes were present in largest proportion did not contain sufficient oxygen to heat the coal to any noticeable extent. The close packing had also so obstructed circulation that little fresh oxygen could have been brought in, even if the temperature had been raised to such an extent as to favour circulation of air. This indicates that one comparatively safe way to store coal is to use enough of the fine sizes to occupy the space as completely as possible, and to pack the coal tightly in order that the air space may be reduced and the circulation of air restricted. Apparently the most dangerous conditions exist when the coal is of such sizes as to present a large aggregate surface for absorption, and at the same time to leave a sufficient air space to provide the oxygen required for heating.

Military Hospital near London

The military authorities plan to establish a large military hospital in Westminster township, beside London, Ont., and a new mobilization camp at Carling's heights in the same vicinity, and the whole undertaking will involve an expenditure of some $1,500,000. The hospital will include four active treatment units, with a capacity of 200 beds each, two convalescent units with the same capacity each, a separate officers' hospital, an isolation hospital, and in addition, a power house, nurses' building, superintendent's residence, administration and discharge buildings, garage and other subsidiary units. The buildings, which will face towards London, will cover an area of about 12 acres, or 500 x 1,000 ft. The mobilization barracks at Carling's Heights will provide winter quarters for two battalions and also will include a hospital of permanent construction for active troops mobilized at that point. The buildings will be of stucco and asbestos, practically fireproof, and will have foundations adequate to carry heavier structures, so that they may later be brick-veneered.

Contractors' Motor Driven Compressors

At this time when the labor problem is a large issue and all economic solutions to it as a problem are a necessity, the portable compressor outfit seems more valuable than ever. Because of the rapidity with which they work and the immense amount of work they save, air operated tools, such as drills, hammers, rivets, chisels, reamers, caulkers and tampers, have been universally employed by contractors and builders. A portable compressor outfit, that can be readily hauled to the job, put immediately to work and promptly removed when wanted elsewhere, forms therefore, a very valuable addition to the contractor's plant. The electrically operated portable compressor illustrated is especially adapted for city work where current is available at all places, and it is more conveniently and easily handled than corresponding steam, gasoline or oil operated types. It consists of a 10 x 12 type E. R. Ingersoll-Rand compressor driven by a 50 h.p. Westinghouse motor, and has a capacity of 300 cubic feet of air per minute at 100 lbs. pressure.

The Dominion Bridge Company, Limited, Montreal, has been awarded the contract for building two large Shipbuilding Cranes of the traveling gantry type with 7 ton man trolleys, for the Tidewater Shipbuilders, Limited, Three Rivers, P. Q.

Quebec Bridge Withstands Final Test

IN the presence of several thousand spectators, including a large number of Canadian Government Railway officials, engineers and officials of the St. Lawrence Bridge Co., and members of the Quebec Bridge Commission, the final test of the Quebec bridge was made on August 22, and the results are considered highly satisfactory. Four trains were used in making the trial. At 2 p.m. the first engine, hauling seventeen loaded freight cars, took up its position on the central span—the total weight of this train was 809 tons. At 2.05 p.m. the second engine, hauling thirty-five cars, steamed out over the span, the total weight in this case being 1,842. At 2.10 o'clock the third train, consisting of the engine and seventeen cars, and weighing 1,209 tons, took up its position on the bridge, and at 2.20 the fourth train, with 36 cars, weight 1,725 tons, pulled out on the structure, the first section resting on the west, or Montreal side tracks, and the second section on the east, or Quebec side tracks. The main test was made by stopping the four Santa Fe locomotives, each weighing 257 tons, at the north end of the south cantilever and the south end of the central span, where the latter is supported by eye bars which were linked up when the span was placed in position in October, 1917. The four trains when placed for the test, stood so as to entirely cover the space between the piers, which is 1,800 ft., and they were resting on the span for a period of 2 hours and 15 minutes. The total number of cars used in the test was 105, besides the four engines, the cars being loaded with coal, steel and gravel. During the test the total weight placed upon the span, in addition to its own weight of 5,500 tons, was 6,627 tons. Under this loading the south anchor lifted half an inch; the floor beam of the main post dropped a quarter inch; the south end of the span dropped 6 ft. 3/16 in.; the centre of the central span dropped 6 ft. 7/18 in., while the north end of the span dropped 4 ft. The difference in the deflection at the ends of the central span is accounted for by the fact that the test was specially made at the south end, where the four engines stood. The total elongation of the steel work during the trial was 1 ft. 5/8 in., not taking into consideration the additional elongation caused by the heat of the day. The weight placed upon the bridge was between 3/4 and 4/5 of the allowable safe load. The reason for leaving the trains on the span for so long a time was for the purpose of taking the measurement of deflections from shore to shore.

Among those present at the test were: Col. C. N. Montserrat, and Mr. H. P. Borden, of the Quebec Bridge Commission, with their assistants, Messrs. J. Rankin, resident engineer, and W. P. Copp, Inspector; Messrs. G. F. Porter and L. G. Jost, engineers of the St. Lawrence Bridge Co.; W. J. Atkinson, asst. superintendent, and L. Brousseau, resident engineer, of the C. G. Rys.. and Mr. Gordon Grant, chief engineer of the Transcontinental Ry.

To Test Sand

An American manufacturer has devised a simple sand tester which will quickly determine the physical properties of sand. The device consists of a graded series of standard mesh screens in a watertight casing, a series of glass vials communicating with the screens, also means for making a graphical record of the test.

The Use of High-Pressure and High-Temperature Steam in Large Power Stations[*]

By J. H. Shaw

THERE is little doubt that the majority of power station engineers have given attention to the efficient utilisation of steam at the lower ranges of temperature and pressure, and have been during the past few years considering the upper range. Here there is rather more scope for choice, but it appears that doubt exists as to whether it is the more economical to increase the temperature of the steam by superheating or to increase the range by the use of higher pressures and a moderate amount of superheat. This question has been shelved to a certain extent, owing to engineers being engaged on war work, and thus unable to give the necessary time and attention to developing plant suitable for the higher ranges.

An interesting plant has been installed by the British Thomson-Houston Company at their Rugby power-house, consisting of a B.T.H. turbine and a Babcock and Wilcox marine type boiler, capable of a normal evaporation of 18,000 lb. per hour with feed-water at 80 deg. Fah.—the working pressure being 350 lb. per square inch, the final temperature of the steam after passing the superheater 700 deg. Fah., and the test pressure of the boiler 525 lb. per square inch. Good results have been obtained from the combination, and an inspection of the machine after about a year's operation showed no undue signs of wear.

At the Carveille power station, Newcastle-on-Tyne, the latest section of the boiler-house is designed for 275 lb. pressure, and at Glasgow the boiler pressure at the new works is to be 250 lb. per square inch.

Does It Pay?

A question that will appeal to all is "Will it pay?"

A good case can be made out for a jump to 600 lb. pressure with a total temperature of 700 deg. to 800 deg. Fah., but this will involve a considerable amount of development charges being borne by the undertaking or undertakings which are the first to adopt such a pressure. On the other hand, it appears that practically all designs of existing apparatus can be so modified as to admit of pressures of 350 lb. to 400 lb. per square inch. It would, therefore, seem that to increase the working range of steam without the development of new designs a pressure of 350 lb. can safely be adpoted, and that if it is decided to increase the range the adoption of a pressure below this is akin to "hedging" the question.

When considering any results of tests on high-pressure or high-temperature steam generating plant, it is essential that the tests on the boiler side and the tests on the turbine side be studied separately; further, it must be remembered that any results obtained on an extra high-pressure boiler can be obtained, and considering the boiler apart from the economiser, surpassed on a similar and similarly equipped low-pressure boiler.

For a comparison between the cost of running a power station at 200 lb. pressure (gauge) and at a 350 lb. pressure, a schedule has been prepared. It is proposed to consider a riverside station, where the water is suitable for surface condensing. It is proposed to install 20,000 kilowatt sets, and coal is assumed to be within a reasonable distance; the cost of the coal, with a net calorific value of 10,000 therms per lb., is for the purpose of the schedule assumed to be 10s. per ton at the works. The incombustible contents of the coal would amount to 20 per cent. The average water temperature is taken to be 60 deg. Fah., and the vacuum 28.5 in., with the barometer at 30in. The overall efficiency of the boiler-house plant is assumed to be 77.5 per cent., which should be obtained with modern boiler control.

Turbine makers are not all in accord to the efficiency to be expected from turbines of the size under consideration when working on high pressures, and, in view of the difference between the view of experts, it will be advisable to look ahead and anticipate that the efficiencies of turbines of the size under consideration will be improved in the near future. For the purpose of the calculations a turbine ratio efficiency of 80 per cent. is assumed at both 200 lb. pressure and 350 lb. pressure with the steam superheated 150 deg. Fah. and a constant vacuum of 28.5in. An alternator of 20,000 kilowatts capacity can no doubt be built to give an efficiency of 97 per cent, at unity power factor, thus making the turbo generator ratio efficiency 0.80 x 0.97-77.6 per cent. Assuming bearing and other friction losses to absorb 2 per cent., the internal efficiency of the turbine will amount to 82 per cent.

Compartive Costs.

The schedule shows the comparisons of coal. steam and heat consumptions for a 20,000-kilowatt machine running under the conditions mentioned, at 200 lb. and 350 lb. pressure by guage at varying superheats; also at 500 lb. pressure absolute and 268 deg. Fah. superheat, at which pressure and superheat the total temperature will be 736.5 deg. Fah., which is about the maximum temperature at present recommended for the materials now being used in turbine construction. The schedule shows that the cost for coal when generating 175.2 million kilwatt-hours with a load factor of 100 per cent. will be £64,400 at the higher pressure—superheat 250 deg. Fah.—and £69,200 at the lower pressure with corresponding superheat. This is a saving of £4800 per 175.2 million kilowatt-hours, or 0.007d. per kilowatt-hour. Unfortunately, a load factor of 100 per cent. is impossible, and the conditions under which power stations are operated must be considered before even an approximate estimate of working costs can be arrived at.

To arrive at an estimated figure for the power stations under discussion, it is proposed to assume that the standing loss of the station designed for 200 lb. will be the same as a typical station—the Valley-road power station of the Bradford Corporation, i.e., 1583 lb. of coal per hour. It will be fair if the same basis is taken for the plant at 350 lb. pressure. with 8 per cent. added to the works standing loss representing roughly the higher temperature of the steam at the higher pressure. Standing losses must be approximately proportional to the top temperature, as this affects radiation, boiler exit losses, etc.

For a 20,000-kilowatt set the no-load consumption will be approximately 22,000 lb. of steam, or 3666 lb. of coal per hour, and the total steam consumption at any load is 22,000 lb. + 9.54 lb. of steam per kilowatt-hour for the plant operating at 200 lb. pressure. and 22,000 lb. + 8.6 lb. of steam per kilowatt-hour and 3729 lb. + 1.45 lb. of coal per kilowatt-hour for the plant operating at 350 lb. pressure and 250 deg. superheat.

In order to allow for changing over, for the period when two or more machines are temporarily running together at partial loads, for reduced efficiency, in the boiler-house due to adverse circumstances, and for the necessity of sometimes running the plant when it is not in the best condition, it will be advisable to add 5 per cent. to the figures obtained for the load consumption and 5 per cent. to the no-load loss of the turbine, thus making the consumptions and costs as below,

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[*] Before the Instituttion of Civil Engineers.

Table I:

	Maximum load of 20,000 kilowatts and 50 per cent. load factor 87.6 x 10^6 units per annum.	
	200 lb. pressure, 250 deg. superheat, 28.5in. vacuum.	350 lb. pressure 250 deg. superheat, 28.5in. vacuum.
Works standing loss in tons of coal	6,200	6,700
No-load consumption of turbo-generators in tons of coal......	15,100	15,314
Load consumption of turbo-generators in tons of coal	65,300	59,867
Total	86,600	81,881
Lb. of coal per unit on station bus-bars	2.211	2.094
Total cost at 10s. per ton	£43,300	£40,940
Cost of coal per unit	0.119d.	0.1122d.

The foregoing relates only to the cost of coal; the remaining items which make up the total works costs are not likely to be affected by the use of higher pressures and temperatures. Oil, waste, and water are practically unaffected; repairs and maintenance may be increased, but not to an appreciable extent.. The capital cost of the plant is an item that may be affected to a considerable extent, but, unfortunately, the increased cost of turbines, boilers, pipes, &c., due to the use of higher pressures and temperatures cannot be given in a paper of this description. Table II. below gives the steam consumption on the conditions specified:

Table II.

Steam pressure at turbine lb per square inch ab.	215	265	215
Total temperature of steam at turbine, deg. Fah.	688	688	688
Superheat at turbine, deg. Fah...	300	281.6	265.6
Total heat of steam (from 32 32 deg. Fah.) therms per lb. ..	1371.3	1368.6	1365.9
Absolute pressure at turbine exhaust, inches (Hg.)..........	1.5	1.5	1.5
Heat drop per lb. of steam, therms	429.2	440.3	449.1
Ratio efficiency of turbine and alternator	79.%	79.1%	79.0
Steam consumption of turbine, lb. per kilowatt-hour	10.023	9.82	9.65
Total steam consumption of turbine, lb. per hour	200,460	196,400	193,000
Steam consumption per effective kilowatt-hour, lb.	10.3	10.10	9.94

With regard to the practical difficulties, it is but to be expected that before pressures of 500 lb. or 600 lb. per square inch are adopted, a radical departure will have to be made in present boiler construction. All square boxes and headers will be eliminated, the drums and tubes will be smaller in diameter, and the design of the boiler made more elastic. The type of boiler will no doubt assume the appearance of a flash boiler, with practically no steam or water reserve, and fired by gas on the surface-combustion principle.

For more moderate pressures, up to 350 lb. per square inch, the existing type of boiler can be modified and successfully used. At Carville power station, Babcock and Wilcox marine-type boilers are being used, at 275 lb. per square inch gauge pressure, and at the British Thomson-Houston Company's works at Rugby a Babcock and Wilcox boiler is installed and successfully working at 350 lb. per square inch. Further, Messrs. Babcock and Wilcox state that they have at present two boilers on order for a working pressure of 475 lb. per square inch with steam superheated to a final temperature of 700 deg. Fah., and that they are quite prepared to supply boilers in their ordinary business for such pressure and superheat.

With higher steam pressures the temperature of saturation is raised, and, due to this, greater care must be exercised in the quality of the water used for the boiler feed. A feedwater that is perfectly satisfactory at 380 deg. Fah. in a modern tubular boiler might be quite unsuitable for use in a flash boiler. The quantity of air, CO_2, and oxygen will have to be kept down to a minimum, and also the non-soluble salts which are generally in the water discharged from an ordinary lime-soda water softener. A natural development, and one which is already taking place, is to heat the feedwater under atmospheric pressure by means of live or exhaust steam in order to drive off the entrapped and dissolved gases as much as possible. According to Lunge's "Technical Chemist's Handbook," it is necessary to raise the temperature of the water to 100 deg. Cent. before the quantity of air in the water is appreciably reduced.

The source of water for use in high-pressure plants will have to be carefully traced, and the treatment of the water should be such that minimum of unsoluble salts remains in it after treatment. The purer the water the greater affinity it has for air, CO_2, and oxygen, and every care should be taken that it is not exposed to the air between the condenser and the boiler. In order to avoid such exposure to the air it is suggested that the feed pump should be an extension of the condensate pump and the condensed water pumped direct into the feed line.

For Higher Pressures.

The natural develpoment of the turbine for higher pressures appears to be in a line with Parsons two-cylinder machine, with a flexible claw-type coupling between the cylinders and a thrust bearing for each cylinder. For very large sets, above 50,000 kilowatts, the cross-compound turbo-generator will no doubt be used, the high-pressure turbine being attached to a generator and the low pressure turbine to another generator. Each set can then be run at its most suitable speed, with resulting high efficiency. This arrangement will no doubt lead to re-heating the steam after it leaves the high-pressure turbine and before entering the low-pressure machine. Dr. Ferranti has already done valuable work on this subject the results of which have unfortunately not been published.

The design of the condensing plant is not likely to be modified because of the use of high pressure or high- temperature steam, but it must not be lost sight of, that with steam initially at the same temperature, but at different pressures the plant using the high-pressure steam will reject less heat units to the condenser per lb. of steam used in the turbine.

The steam pipes to be used in a station where both high pressures and high temperatures are employed will have to be very carefully designed. The question of expansion at higher temperatures will be of the utmost importance. For example, take the case of a steam pipe 100 ft. in length, and assume that the pipe had been erected at 60 deg. Fah. It will be found that a temperature of 388 deg. Fah., equal to steam at 200 lb. gauge saturated, the expansion is 2.59in., while at 786.6 deg. Fah., equal to steam at 600 lb. pressure and 300 deg. Fah. superheat, the expansion is 5.75 in.

The expansion given can be readily taken care of if the designer can ensure that the expansion would always take place lengthwise in the pipe range. Unfortunately, taking a boiler off a range will cause a considerable cross-strain to the main header, due to the connecting pipes cooling down and contracting.

It appears that the main steam connections of the boiler will have to be designed in a flexible manner, in order to relieve the main range of stress. Further, these connections should be of the manifold or header type, i.e., made up of many small pipe connections.

From inquiries, it is apparent that the boiler mounting and valve makers are quite alive to the possibilities of high-pressure and high-temperature steam coming into commercial use. The question of the use of higher pressures is quite appreciated by the makers of economisers, who are prepared to manufacture economisers for 350 lb. boiler pressure or higher, either of their standard design, with the details modified, or of a design suitable for use as an integral part of the boiler, if necessary with horiontal and mild steel tubes.

It must be admitted that in order to attain a higher overall efficiency, it is necessary to increase both the pressure and the temperature of the steam. An increase of pressure with a constant temperature would mean that the dew point is carried further up the turbine towards the high-pressure end, thus tending to accelerate blade eroision in the lower stages and a reduced stage efficiency of the turbine. Also the high-pressure blading of a turbine is considerably less efficient than the low pressure stages, and although the losses in the high-pressure end are partly recovered in the low-pressure blades, it is apparant that to assume that a turbine for extra high pressures can be built with the same efficiency as one for a lower pressure—within limits—is taking a hopeful view, and that there is justification for hesitation before adopting extra high pressures on the part of managers responsible for the financial results of large undertakings.

Mainly Constructional

East and West—From Coast to Coast

The building by-law to be introduced in Renfrew, Ont., has had its first reading.

At a recent meeting the common council of St. John, N. B., decided to extend the water service to East St. John.

The Belcher's Islands Iron Mines, Limited, have been incorporated with a capital stock of $1,000,000, head office, Toronto.

The city of Chatham will petition the government to have the proposed inter-provincial highway pass through Chatham to Windsor.

A general appropriation of $750 was made to each ward for road work by the municipal council of Langely, B. C., at a recent meeting.

The Dover Oil Company, Limited, has been incorporated with a capital of $1,000,000 to acquire, own, lease, prospect for, and manage mines and mineral land deposits, including oil and gas.

A by-law providing for the construction of a filtration plant at an expenditure of $250,000 to $300,000 will be submitted to the ratepayers of Windsor, Ont., at the January municipal elections.

It is reported that the military authorities contemplate the purchase of Central Park, near Vancouver, for the erection of a large hospital to care for British Columbia soldier patients, excepting tubercular cases.

The enlargement of Guleph's water reservoir to accommodate 5,000,000 gallons and the installation of an additional pump at the works with a capaicty of 6,000,000 gallons a day, are recommended in a report submitted to the city of Guelph by the Provincial Fire Underwriters of Ontario. The adoption of nothing less than six inch mains is also recommended.

Building permits to the value of $31,494 were issued in Sydney, N.S., during the month of July. The total for the first seven months of the year is $225,884, as compared with $174,041 for the corresponding period in 1917.

The Malcolm Construction Company, Limited, has taken out letters patent of incorporation in the province of Manitoba, being authorized to carry on a building and contracting business; head office, Winnipeg; capital, $5,000.

Plans have been approved for three temporary schools to be erected in Winnipeg at a cost of $100,000. One is to be located near Cecil Rhodes school, the second near McGregor street barracks, and the third at Riverview

At a meeting of the shareholders of the Ontario Portland Cement Co., Ltd., at Brantford, Ont., recently, it was decided to go into voluntary liquidation, the supply of marl at their plant at Blue Lake having become exhausted.

The city council of Chatham, Ont., have been considering the question of borrowing money from the Ontario government for the erection of workmen's houses and appear favorable to this course. No definite action has yet been taken, however.

Joseph Gawley, Limited, has been incorporated with a capital of $10,000, head office at Vancouver. The objects of this concern, as stated in its charter, include "the businesses of brokerage, engineering, contracting, manufacturing operating, and trading."

Housing conditions in Moncton, N.B., are said to be nothing short of desperate. Tenements are greatly overcrowded and in the poorer quarters families are glad to obtain quarters of any kind, and are actually found to be living in sheds, barns, attics and cellars.

Nine Toronto firms have entered into an agreement with the labor organizations to pay a minimum wage of $1 an hour to forge men. The schedule calls for a nine-hour day, with time and a half until 10 o'clock and then double time, and also double time on Sundays and holidays.

A party in charge of Mr. W. A. Ducker have been sent out to make a topographical survey of the Manitoba provincial industrial farm with a view to the commencement of work on the erection of buildings, etc. There is said to be good brick clay on the site and also large quantities of granite in the vicinity.

The munitions plant at Leaside, Toronto, is to be enlarged at a cost of at least $3,000,000, according to a recent announcement. The plans call for the erection of two buildings of brick and steel construction, one 280 ft. long and the larger one 640 ft. Work has been started and 500 workmen are already on the job. The new space will be devoted entirely to taking care of an order for 12-inch shells for the U. S. war department.

A suggestion is made that a new wing be added to the Parliament Building in Toronto at a cost of about $1,000,000, to relieve the congestion which at present exists amongst the various government departments. This addition would be built on the east side of the building, running northwards and following generally the lines of the new western wing built a few years ago after the fire. Owing to war conditions, it is not expected that this work will be undertaken for some time.

The Ottawa city council at a recent meeting decided to ask the government's permission for the issue of bonds to the amount of $125,000. This money is required for the erection of a new bridge over the Rideau River on St. Patrick

St. It is probable, however, that the total sum required will be about $190,000. Many of the members of the council are strongly opposed to the erection of the new structure, stating that the present bridge is not in a dangerous condition and will meet the requirements for some time.

Officials of the city of Ottawa and county of Carleton have been discussing the construction of a new bridge over the Rideau river to replace Cumming's. It is considered that a reinforced concrete structure would be the most suitable, and plans have been prepared for a bridge of this type to cost about $175,000. The present steel bridge has seen service for more than 25 years, having been repaired from time to time. It is in such a state at present that loads crossing it are limited to 3,000 pounds.

A most representative gathering was recently held at Brandon, Man., to discuss the good roads situation, reeves and councillors being present from the various municipalities surrounding the city and from as far west as the Saskatchewan boundary. The matter of the road through to the Saskatchewan boundary was brought, and while nothing definite was decided, it is expected that action will be taken in the near future to establish this highway. As a result of the meeting the city council of Brandon arranged a trip over the good roads system in the municipality of Wallace for the representatives of the various municipalities concerned.

Considerable road work is being carried on in Montreal at the present time, including the following: Levelling Westhill from Sherbrooke street north; asphalting Bleury from Ontario to Sherbrook, St. Catharine from Stanley to Guy, St. Catharine, east of Papineau, and Mary Ann street; laying Scoria blocks on St. Lawrence, corner of Martin; granite blocks, Craig street corner of Amherst, Little Craig street, from Cote des Neiges to Decare, St. Patrick corner of Island, Inspector from St. James to Notre Dame; macadam, Western avenue from Grand Boulevard to Benny, Queen Mary from Cote des Neiges to Decare, St. Hubert from Beaubien to St. Zotique, Laurier from Chamford to Garnier, and Gilford from Breboeuf to De la Roche.

The work of pouring concrete has been completed and masonry work is now under way on the new school at Rossland, B.C. It is expected to be completed within the next two or three months. The building is of two storeys, containing twelve classrooms, teachers' rooms, principal's office; also it will have a basement, in which will be located rooms for domestic science, manual training, furnace room, fan room, coal bunkers, lavatories and play rooms. The floors of the corridors, and the stairs, are of reinforced concrete, and the partitions on the main floor are of hollow tile. In view of exceptional climatic conditions during the winter season, the roof is to be of the "well deck type," having drainage to the centre of the building. Mr. J. H. Bowman, architect, drew the plans for the school, and Mr. Robt. Moncrieff has the contract for its erection.

The building permits issued in Toronto during the month of July indicate a marked increase in building activity as compared with last year. The records of the city architect's department show the following figures: Total for month of July, 1918, 475 permits, value $1,094,278; total for July, 1917, 425 permits, value $762,604; total first seven months, 1918, $4,83529,; first seven months, 1917, $4,087,782; permits for dwellings, July, 1918, 111, $272,200; permits for dwellings, July, 1917, 87, $209,800; permits for dwellings during first seven months of 1918, 641, $1,611,075; permits for dwellings during first seven months of 1917, 530, $1,328,875; permits for factory buildings and warehouses, July, 1918, $466,000; permits for factory buildings and warehouses, July, 1917, $151,200; permits for factory buildings and warehouses during first seven months of 1918, $1,702,950; permits for same class of buildings corresponding period 1917, $1,305,050.

The city commissioners of Montreal are planning the road work which it is proposed to carry out next year, and although definite decision has not been reached, it is understood that the appropriations for new work which will be included in the budget will amount to about $400,000 and that this will be devoted to putting in proper condition the main approaches of the city. The southern approach from Victoria bridge along Bridge St. will, it is stated, be entirely reconstructed, the present macadam pavement to be replaced with granite blocks at an estimated cost of $85,000. The westerly approach, along Sherbrooke St., including Western Ave., to the limits of Montreal West, will be paved with asphalt, the cost being estimated at $140,000, and $80,000 is to be appropriated for the asphalt paving of St. Lawrence Boulevard, part of which will, it is understood, be commenced this summer. Cote des Neiges road, leading from Guy street up to the cemetries, will also be reconstructed.

The programme of the provincial department of Highways in Saskatchewan is progressing favorably, according to a recently issued report, the expenditure involved being approximately $110,000. The concrete bridge over the Arm river, near Craik, for which O. W. Smith & Co. were awarded the contract, will shortly be in commission. The new bridge at Maple Creek and that over the Qu'Appelle river, south of Disley, are both well under way; also a structure at Cote, and one near Courval, south of Mortlach, between Johnstone and Chaplain lakes. Tenders have been called for a bridge at Eastend and one south and east of Webb, and it is expected that both of these structures will be finished this fall. A contract has been entered into with the rural municipality of Maripoas for the repair of the large grade across White Heron Lake, near Kerrobert—a new style of protection is being adopted to prevent deterioration through wave wash, willow brush, tied to fascines, being placed along the sides of the grade to protect the earth slopes. The annual programme of small timber bridge construction, although somewhat restricted, is being carriel out by the department with regular labor crews. Five crews are at work in various parts of the province.

Personals

Mr. John Hastie, president of the New Westminster Construction & Engineering Co., Ltd., recently visted the east in connection with the securing of contractors for the Poplar Island shipyard of the company.

Mr. Alcide Chausse has resigned as city architect and superintendent of buildings of the city of Montreal and has resumed the practice of his porfession at 367 Beaver Hall Square in that city. He will be pleased to receive catalogues, etc., from building supply firms.

Obituary

Mr. Henry Geo. Love, who, until his retirement a few years ago, was a partner in the firm of Brown & Love, builders, died recently at his home in Toronto. The late Mr. Love was born in Bristol, England, in 1842, and came to Canada in 1871.

Mr. Thos. J. Rutherford, president of the lumber firm of Wm. Rutherford & Sons, Montreal, died suddenly at his summer home at Trout Lake, near Ste. Agathe, at the age of 59 years. He had been in poor health for some time, but it was not thought his illness would end fatally. Mr. Rutherford was born in Montreal and had lived most of his life in Westmount. His eldest son, Lieut. Archibald B. Rutherford, M. M., enlisted in the ranks with the Engineers in 1915, and won the Military Medal for gallant conduct, while a few months ago he was granted a commission as lieutenant as a further recognition of his services.

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The Commission-Manager Plan of City Government

THERE is no more fascinating subject under discussion at the present time than the possibilities underlying the reorganization of the present thoroughly and hopelessly inefficient and unsatisfactory system of management as exemplified by the vast majority of the councils and mayors of Canadian towns and cities. And by this it is not intended to suggest that the fault rests entirely with these officers themselves. The plain fact is—the system is wrong, unbusinesslike and indefensible. At election time the mayor and councillors tell what they are going to do—or have already done—matters of policy. They rarely, if ever, try to convince the electors that this policy will be carried out efficiently. As a matter of fact it depends on the personality of these men largely—their influence with this and that organization whether or not they can carry on their policy at all. The energies of the mayor, instead of being devoted to seeing to it that the various departments are operating efficiently, are chiefly directed towards keeping a sufficient majority on his side to enable him to pursue the policy outlined. At the same time he must keep his eye on the electorate, having in mind the next election date. The net result of the whole matter is that first-rate men will not offer themselves for election and we have a bad system of government operated, in many cases, by second-rate men—men, often, who have demonstrated their entire inability to manage their own private affairs on even the smallest scale.

The management of a city or large town is as much a "business" as the management of a bank, a factory or any industrial enterprise. It requires the same kind of brains, the same concentration, the same independence of action. It requires qualities rarely found in the man who can sway the popular vote. In other words, the position can only be properly filled by appointment—an efficiency manager, not specially interested in policy, not subject to the whims and intrigues of petty politics.

In certain European countries, and more recently in the United States, the commission-manager plan, closely resembling the board of directors and manager of the average private organization, has proven a marked success. The commission is elected and is responsible for the policy; the manager is appointed and is subject to long tenure of office if efficient, or to summary dismissal if unsatisfactory, just as in a private organization. For the double reason that our present system is about as bad at is can be and that the suggested plan is proving satisfactory in a large majority of cases, why not give it a trial in Toronto, Montreal, and elsewhere in Canada?

Replacing Our Marine Losses

TO cope with the emergency occasioned, by enemy submarines, we are returning to the wooden ship which we have long since come to consider as permanently superseded. The great shipyards of America were designed and organized for the construction of the modern steel ship but the difficulty of obtaining material and the necessity of increased output, to say nothing of cost, is responsible for the revival of an ancient industry.

As the output of the shipyards was of primary importance the most famous marine engineers in the country combined in their efforts to devise means to speed up work in the yards. That these efforts were successful is well demonstrated by the tonnage output in the last year as compared with previous years The ships have been standardized in every way possible to facilitate manufacture. This standardization together with the development and application of modern practice, as applied to ship building, has worked a revolution in the wooden ship industry.

Those of us who are connected with, or interested in, the iron and steel industry, will readily realize the vital importance of substituting wherever possible, to conserve these materials. The munitions output in this country and various other war material requirements have placed such a load on the steel plants that they are pushed to capacity.

The boiler and engine requirements necessary to meet the enormous output of steel and wooden ships already contracted for leaves practically no power available for privately built concrete ships. Many of the most widely known marine engineers have expressed their faith in the possibilities of the concrete ship and they say it is just a matter of time before this is demonstrated. However, in our ship construction campaign time is the essence of the contract.

Fire Protection Engineering

Do our engineering departments or works organizations give sufficient thought and attention to the details of "Fire Protection?" Fire protection requires, essentially, a close study of the details, not only in the construction of your buildings, but in the layout of the equipment necessary in your process of manufacture and methods of operation.

The building restrictions of our cities do, to a certain extent, require the observence of certain formalities, and the installation of certain equipment, before a permit to erect the building is granted, but this does not, of necessity, mean fireproof construction.

Have you ever stopped to consider how many of our alleged fireproof buildings are damaged or totally destroyed by fire? The fire losses in Canada and the United States are appalling. The United States and Canadian losses combined in 1917 amounted to $267,273,140, and the aggregate fire waste of the United States and Canada during the past forty years, from 1878 to 1917, inclusive, reaches the appalling total of $6,480,267,560, showing an annual average property destruction of $162,006,689. Add to this the loss of business due to suspended operation and it furnishes material for serious consideration. In many cases a carefully designed slow burning type of building, well equipped with approved fire protection appliances, and fire resisting or retarding construction details, is a much better fire risk than a so called, fireproof type in which the important details have been overlooked.

Another very important subject for consideration is the use of highly inflammable, or explosive materials where their use is not absolutely imperative. In many industrial plants, gasoline baths were considered necessary to clean certain metal products. After experimenting it was discovered that certain alkali baths were equally as good and the danger of fire was eliminated. Workmen are loath to change their ideas and the methods they have used for years and this is one of the difficulties manufacturers have to contend against in innovations of this kind but it is the duty of everyone to see that every possible risk of fire is avoided. It is the duty of your works or engineering department to educate your employees and the campaign cannot be started too soon.

Do not think, because you have had your plant equipped with a sprinkler system, that you have done your utmost to protect yourself from fire and have fulfilled your duty.

Temporary Barracks in Fredericton, N.B.

The Department of Public Works, Ottawa has prepared plans for a number of temporary barrack buildings at Fredericton, N. B. These consist of 8 men's barracks, two men's mess buildings, four ablution buildings, two recreation buildings, the usual Quartermaster's stores and canteen buildings, two battalion office buildings, two sergeants' mess buildings, two guard houses and an officers' mess building. For construction purposes, the buildings are divided into two units, the first consisting of four barracks, one mess building, two ablution buildings, 1 recreation room Q. M. stores and canteen, one battalion officers' building, 1 sergeants' mess building, 1 guard room; the second unit comprises the balance of the structures.

All the buildings are of frame construction, there being some slight variations according to the class of the different structures. In the case of the two storey buildings, the exterior walls are to be of 2 x 6 studding from the ground floor to the first floor and from the latter to the rafter plates, 2 x 4 studding. The external walls of one storey buildings are to be of 2 x 4 studding to the full height. All the studs are to be 16-inch on centres and doubled at the corners. These walls are to be sheathed on the outside with ⅞ in. T. and G. spruce or hemlock, while the interior face will be covered with waterproof paper and wall board. The interior partitions are to be 2 x 4 in. studding, spruce or hemlock, and the interior posts of dressed spruce. Both sides of the partitions and the ceilings will be covered with wall board. The roof will be of heavy timbers with ⅞ in. T. and G. board.

The plans provide for ⅞-in. T. and G. spruce or hemlock for the floors; this is to be laid diagonally, covered with waterproof paper, and on top of this will be ⅞-inch T. and G. spruce flooring.

In the kitchens, the cold storage rooms will be constructed of four thicknesses of Neponset insulating paper between each thickness of sheathing. The serving tables will be of spruce. Under all the ranges in the kitchens, concrete hearths will be built of two inches of concrete over beds of 6-inch steam cinders.

The men's barracks are the largest of the structures. They consist mainly of dormitories, the partitions being made of ⅞-inch T. and G. spruce vertical sheathing to the height of within 3 ft. of the ceilings. The tops are to be filled in with heavy galvanized iron wire netting. On the ground floors are rooms for the sergeants and on the second floors similar rooms and offices and pay offices.

The central portion of the men's mess buildings is occupied by four kitchens, two on each side of the ranges, which are in the middle of the building. At the sides of the kitchens are service tables, opening out into the mess rooms; the latter contain long rows of tables. At the rear of the kitchens is cold storage accommodation.

The ablution buildings have a number of closets, latrines, drying rooms and shower baths.

In the recreation and canteen buildings, provision is made for tailors' and shoemakers' and armourers' rooms. The N.C.O. recreation room and canteens are situated in the centre, and at the ends are the men's recreation quarters.

The battalion office buildings comprise orderly rooms and accommodation for the adjutant, doctor, O.C., pay clerks, clerks, etc. The buildings have central corridors, with the rooms arranged on either side.

Besides mess rooms, the sergeants' mess buildings have writing and game rooms, kitchens and cold storage. The guard houses consist of detention rooms, cells with folding bunks, etc.

The officers' mess building is of two storeys. The mess room is on the ground floor, and runs the entire length of the front portion of the building; behind it are large ante rooms, kitchens, and store room. The next floor contains the officers' quarters, on each side of a central corridor. The rooms are partitioned off. The toilets are provided with shower baths.

A special committee has been appointed by the board of works of London, Ont., to look into the cost of rebuilding the Springbank dam which was undermined during the spring freshets. It has not as yet been definitely decided whether this work will be carried out.

Unification of Local Governments and the City Manager Plan

By George C. Sikes*

ENGINEERS, of course, have the same responsibility as other citizens for helping to promote good government in communities in which they live. They have also a larger responsibility in such matters than have ordinary citizens because of their training and their greater ability in thinking wisely on public problems. They should have a greater interest in the general efficiency of governmental systems, too, because in their professional capacity they so frequently come in contact with governmental agencies. Governments managed on the basis of efficiency invoke the aid of capable engineers much more frequently than do those operated on familiar political lines. It is highly significant that in City Manager cities engineers are often called to the post of city manager.

Major General George W. Goethals, the engineer who built the Panama Canal, because of his experience in that task and because of his study of the subject, has become a believer in the City Manager plan of government for American municipalities. In building the Panama Canal, General Goethals was confronted with problems of government and of sanitation that were even more difficult to solve in many ways than were the problems of engineering encountered. General Goethals applied the direct processes of his well-trained mind to the problems of government involved in such a way as to produce a simple and efficient system of administration. In an address delivered on March 17, 1917, in Cleveland, Ohio, before a committee of citizens considering the subject of governmental reorganization for that community, General Goethals declared himself a believer in the city manager plan of government. He said: "I became interested in the subject because I was offered the city managership of two cities, and I read up on the subject, and the more I read on it the more firmly I became convinced that with the proper city manager we approach more nearly the ideal form of government. It concentrates responsibility on the shoulders of one man who is hired for the purpose of serving the city, and it vests him with full authority. In most cases the legislative body consists of a commission, or a council, or whatever you choose to call it, of five to seven men, selected from the city at large by citizens of the city, and these men hire the city manager. The city manager's business is to conduct the business of the city on strictly business principles, and if he is not satisfactory he is discharged and another man called in. The city manager form of government permits the adoption of a continuous policy, which is not possible under our political form of government in cities."

Continuity of Policy.

The city manager plan of government, thus strongly endorsed by General Goethals, is one that the Chicago Bureau of Public Efficiency is urging for Chicago. The Bureau was organized in August, 1910. It is a citizen agency, supported by private contributions. Its function is to study the expenditures of local governing bodies in Chicago and to make recommendations designed to promote efficiency and economy. The Bureau began with the detailed study of particular offices, such as the office of recorder, sheriff, county treasurer, the park governments, and departments of the city government. As a result of the studies and reports of the bureau, improvements were effected in many offices. In some cases the heads of the offices welcomed the suggestions and acted upon them. In other instances the suggestions were ignored.

It was not long before the bureau came to the conclusion that the greatest need of Chicago was the fundamental reorganization of its local governments upon the basis of unity, simplicity, and the short ballot. Under our present complex system it is impossible for local officials, even though they were all saints, to give the community really efficient and economical government. These officials might work greater improvement than they do, but there are many things which cannot be accomplished by independent governing agencies and officials each working in a separate field without co-ordination or central control. Chicago at the present time has 22 separate and more or less independent governing agencies. There are the county, the sanitary district, the city itself, the three large park systems, and 13 small park districts. All of these governments are independent of each other. In addition, there are semi-independent governing agencies — the school board, the library board, and the tuberculosis sanitarium—for each of which there is a separate tax levy, though these agencies are closely related to the city government because their governing boards are appointed by the mayor, with the confirmation of the city council, and their tax levies must be made by the city council.

In the report of the Chicago Bureau of Public Efficiency on the Unification of Local Governments in Chicago, published in January, 1917, the bureau urged the consolidation of all these governing bodies into one. It went further and urged the enlargement of the unified city so as to take in Evanston, Oak Park, and the other settled territory comprising metropolitan Chicago. The bureau would have the agricultural portions of Cook County detached from the consolidated city and county of Chicago, and it would have the detached parts annexed to adjoining counties. The Bureau has suggested that the boundary lines of the enlarged and unified Chicago should be substantially those of the present sanitary district of Chicago.

Having arrived at the conclusion that the entire area within what might be termed metropolitan Chicago should be brought under one local government, the question arose as to the best form of government for the unified municipality. It would be possible, of course, to merge all the other local governments with the city as now constituted, under which there is an elective mayor and an elective council, each more or less independent of the other, and the two often pulling at cross purposes. The bureau went into this matter quite fully. It made a study of the trend of municipal government in the United States and in other civilized countries. It came to the conclusion that the best form of government for a city is that described as the city manager form. This plan is in use in perhaps 75 cities and villages of the United States, the largest being Dayton, Ohio, with a population of about 150,000.

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*Chicago Bureau of Public Efficiency. Before the Western Society of Engineers.

Commission with Manager

The city manager plan of government as used in American cities is the commission plan substantially as originated in Galveston, with the manager feature added. The commission plan of government was an improvement for smaller cities over the mayor-council plan that had been in use previously. It is not theoretically sound, however, and in larger municipalities in which it has been tried it has revealed weaknesses. Under the commission plan, as used in Galveston, Des Moines, and other cities, the powers of legislation and administration are vested in a small commission, usually of five members, each of the commissioners being a department head. The presiding officer of the commission is usually called the mayor, but he does not have the veto or appointing powers possessed by mayors in American cities generally. Ordinances are passed by a majority vote of the commissioners, sometimes subject to popular referendum features, and appointments are made by the commission rather than by the mayor. Each commissioner is a department head. This is where the trouble arises from the commission plan. There is danger that each department head under a system of courtesy and log-rolling will be permitted to manage his department as he pleases without interference from the commission as a whole. Under the city manager plan, or the commission-manager plan, as it is more commonly called, the commission is the repository of both legislative and administrative authority but the administrative power is exercised through a manager selected by the commission and subject to removal at any time, just as the manager of a business house would be. This plan is simple and logical and in nearly ever place in which it has been tried it has given satisfactory results.

Not a New Plan.

Well governed cities of the world outside of the United States for the most part have long had what is the city manager plan in fundamental essence, though they do not use that term. In cities of England, France, Germany, and Australia, the people do not as a rule select administrative officials. They vote only for members of the local legislative body and that body is the repository of administrative as well as legislative powers. It administers usually through an agent or agents of its selection. American business corporations and American universities are managed much in the same way. The stockholders of a business corporation choose the directors and the board of directors names the executive officials. The status of a university president is much like that of a city manager.

Thus the city manager plan, as it is called in the United States, is not new, but really represents a return to first principles, both of city government and of business. Originally, American cities had substantially this form of government. Prior to the adoption of the federal constitution, New York and Philadelphia, to take but two illustrations, had governments corresponding in form much to the government of a British city of to-day. There was no elective mayor. All the power was vested in the city council which administered either through committees or through executive agents of its selection. Following the adoption of the federal constitution, American cities gradually abandoned their simple forms of government and imitated the federal model, with its division of powers and checks and balances, without much thought as to whether that plan was designed to meet city conditions. The checks and balances grew more numerous rather than fewer, with the result that cities in the United States to-day for the most part have systems of government far more complex than is that of the United States.

The bureau believes a mistake has been made and that there should be a reversion to simplicity and centralized responsibility. Whatever may be said for the divisions of power and the checks and balances in the federal system, it is clear that they should not be applied as they have been to municipalities. Instead of a separation of the executive and legislative powers, there should be a mingling of the two under unified control. The council as the policy determining agency of the government should also have supervision and control of the administrative agents that are to carry out the policies.

In accordance with this line of reasoning, the bureau recommended that the unified government of Chicago should be of the city manager type. The essence of the city manager plan is the merging of legislative and administrative authority in the city council, in which is vested the selection and continuous control of the executive agents. It is immaterial whether this legislative body be a commission of five members elected at large or a council of greater size chosen by districts or wards. For smaller municipalities the commission elected at large is probably better, but the bureau believes that for large cities the council should have more than five members and that the method of selection by wards is the better one. For Chicago, the bureau recommended a council of 35 members, one from each of 35 wards, elected for four year terms, subject to popular recall. The plan of the Bureau of Public Efficiency calls for the selection of the mayor by the council, the mayor to hold office under indefinite tenure and to be subject to removal at any time. This mayor, who would be virtually a manager, would have the appointment of heads of departments, who, like the mayor himself, would hold office without fixed tenure.

Discussion.

Some further forceful arguments were advanced in the discussion following the reading of the above paper by Mr. C. D. Hill, who said: I think this subject is of interest to engineers from the standpoint that the office of the manager of the city is one that is particularly appropriate for engineers to fill. But I would rather discuss the political feature as it would be applied in the city of Chicago. I have had the opportunity for more than twenty-five years of watching very closely the operations of the government in the city of Chicago and I have quite definite opinions on the subject, based upon that observation.

The policy forming body of the city of Chicago has been the city council. It is true that at election time the mayor tells what he is going to do or what he has already done, and he talks about matters of policy, but they are usually things that the city council will be called upon to do or that the city council has done. The mayor can not carry out any policy in the city of Chicago unless he has the co-operation and sanction of the council itself.

Sometimes, in order to carry out this policy he is obliged to use force, that is, influence which is more or less harmful. That has been shown in a number of cases. In other cases the mayor has failed to carry out his policy because he couldn't get the majority on his side. Then we have had conflict and discord and a condition of government which is not at all satisfactory.

The elector in voting for officials is nearly always interested in the question of policy. He is very seldom interested in efficient management of the office. It is a question of municipal ownership or the price of gas or something of that sort. You never hear of any talk to influence votes on the theory that the men that are employed by the city are going to earn their wages or do the work efficiently. The electors should elect the men who are going to determine the policy. On the other hand, the mayor of Chicago, if he has nothing to do with the matters of policy, if he merely carries out the policy which is decided by the council, has quite sufficient to do. There are very few men in big business who have a larger business to carry on than the mayor would have if he simply attended to the executive business of the city of Chicago; if he simply saw that the heads of his departments and their subheads and the employees were carrying on the work of the city in an efficient manner, and were carrying out the will of the people, as expressed by the council. But as a matter of fact, in all the 25 years I have watched the city of Chicago I have seldom observed the mayor do anything of the sort. He has always been interested in either the question of policy of the city or the policy of the party to which he belonged.

The council of the city of Chicago is not controlled by political factions and parties. There are too many factions and parties for any one of them to secure a majority of the council. There has always been a working majority that has been composed of members of all of the factions and parties. And there have even been independent members, men who have been elected to the council strictly as independents; perhaps as a Socialist or something of that sort, who have belonged to the working majority. This working majority generally has a definite policy. That is to say, during all those 25 years the city council has been working along certain lines, developing policies, getting through with them, and developing other policies. And this working majority is a continuing body. It isn't changed very materially at election time. A sufficient number of aldermen are re-elected and the men who are re-elected have more influence than the other aldermen, as they have had more experience. They secure positions on the important committees, so that this working majority is really quite an efficient body. There have been in the press at different times criticisms of the city council. Sometimes the criticisms have been too severe. Sometimes they were perhaps justified as to certain individuals, but I doubt whether any legislative body in this country has a higher average of intelligence for its work—the thing it has to do—that has higher standards of sincerity and honesty than the working majority of the city council in the past 25 years.

The mayor when he is elected either becomes the head of his particular party or becomes the head of the faction of that party. There is no use of going into details, but history shows that in the case of every man that has been elected mayor, as soon as he is mayor he then becomes or attempts to become, the head of his particular party. And as the head of that party he has very numerous political duties to perform.

When he becomes a partizan and deals with the city council as a partizan, he stimulates a partizan reaction in the city council, so that anything that he may propose, because it is proposed by the head of one faction will be opposed by aldermen who belong to other factions and other parties. If the mayor attempts to carry on a partizan political government he has to oppose a majority of the council. That is because of the fact that the council is composed of so many factions that only a minority is in harmony with a partizan mayor at any given time. Without the partizanship of the mayor the partizanship of the council disappears, except possibly at the time of election.

A manager who is selected by the council would not be a partizan, because he would represent the working majority, which, in itself, is not partizan. He would have to carry out the ideas of the working majority, and he would have no duties outside of that. In fact if he attempted to play politics at any time he would antagonize the majority of the men who elected him. So it would be necessary for him to sustain the working majority. And if he tried to curry favor with this or that alderman he would get the enmity of two or three others probably. So he would devote his entire time to his executive duties. Then, if he was competent, he would probably remain in office indefinitely We know that when there is a change in the office of mayor there is always a great temptation to make a change through all the other departments, and such changes are made if they can be made. On the other hand, in the city council, where the city council itself controls the appointment of committees, the men on the committees continue in office year after year in spite of the changes in the council. The council know these men, know they are right, and so they keep them there. I have no doubt that any man appointed by the city council, if he did his work well, and was really competent, would continue just as long as he continued to hold their confidence. The same would be true as to the heads of his department.

Big Montreal City Garage

The Montreal commissioners are having the northern yard of the city corporation on de Fleurimont St. turned into a big garage for the storage of all city appliances and the housing of cars. A large, one-storey building will be erected, and all automobiles belonging to the city, with the exception of the mayor's car, the paymaster's car, and one or two of the cars used by the directors of departments, will be kept there, and will only be taken out on authorization from the director of the department concerned. It is anticipated that as soon as this municipal garage is in operation a considerable saving will be effected in the automobile expenses of the city, as a record will be kept of every car that goes out from the garage and the length of time it is away, by whom it is used, and the quantity of gasoline consumed. This will prevent cars being used on other than city business.

Cement joints in the cast iron water mains at Redlands, Cal., have given perfect satisfaction, according to Geo. S. Hinckley, City Engineer, and have proved much more economical to make than lead ones. The joints of all the cast iron water pipe in this city are made of cement.

Economy in the Design of Columns for Concrete Buildings

By Clayton W. Mayers*

PROBABLY no part of a concrete building is simpler to design than the columns, and because of this simplicity the designer is very likely to give this part of his computations very little special study. It is also true that no part of a concrete building can canceal so effectively the lack of economical design, as can the colunms.

The economical design of the columns for a concrete building of only one or even two stories in height, is not a matter requiring much special study, but in buildings several stories in height the subject is one of vast importance. It is not possible to design columns showing maximum economy without careful consideration of several important facts. Engineers designing concrete buildings realize that a richer mix of concrete costs more than a leaner mix. They realize that to offset this extra cost of a richer mix of concrete in column design, there is a corresponding decrease in reinforcement which results in a change in the total costs of the concrete columns. The manipulation of these mixes of concrete in order to determine the most economical column construction is a subject for real study and to accomplish this end the engineer will find it necessary to make several trial designs and calculate the cost of each design. For example, a column 26 in. in diameter, composed of concrete mixed in the proportion of 1 : 1½ : 3, reinforced with eleven 1-in. round rods and 1 per cent. spiral hooping, will carry about the same load as a column of the same diameter composed of 1 : 1 : 2 concrete, reinforced with seven ⅞-in. round rods and 1 per cent. spiral hooping. As both of these are good designs, the question arises as to which one would be the most economical. Assuming the unit price of 1 : 1½ : 3 and 1 : 1 : 2 concrete at 36 cents and 43 cents per cu. ft. respectively, vertical reinforcement at 5 cents per lb., and spiral hooping at 5½ cents per lb. in place, it can be clearly shown that the column composed of 1 : 1 : 2 concrete will prove to be the more economical one to use. The point at which the column mixes change and where spirally reinforced columns should be used is determined only by making these comparative estimates.

It is not uncommon to see detailed plans calling for a lap in all the rods in a lower story column without regard to the fact that the column above may call for a lesser number of rods for its reinforcement, and it is only necessary to lap part of them. This is real waste and shows careless design which will run into money faster than the designer suspects. For illustration, the first story wall columns of a concrete building are 36 x 24 in., reinforced with twenty 1⅛-in. round rods. The second story wall columns are 36 x 30 in., reinforced with fourteen 1⅛-in. rods. A lap of thirty diameters is called for in all column rods. If the entire twenty rods in a first story column are lapped into the second story column it means that six of these twenty 1⅛-in. rods have been unnecessarily lapped and consequently this extra reinforcement wasted. Had only fourteen of these first story column rods been lapped into the second story column instead of twenty, a saving of about 17 lin. ft. of 1⅛-in. round steel rod would have been made. This reinforcement, figured at 5 cents per lb., would have shown a saving of about $3 at this one point. Multiply this saving by the number of columns in the building where such laps occur and it becomes no small item. The expense of a cost of this kind becomes considerably greater when the column in question is a wall column on which is superimposed a so-called turned up wall beam designed to be poured with the floor slab. In this case the specified lap begins at the top of the wall beam instead of the top of the floor slab and extends upward. For example, suppose a wall beam, extending 14 in. above the second floor, designed to be poured with the slab, had been superimposed on the 36 x 34-in. wall column just discussed. In this case the lap must be measured from the point where pouring is stopped. If the twenty 1⅛-in. round rods are all carried up into the second story column for a lap of 30 diameters it means that all the rods must extend to a point 4 ft. above the second floor, when in reality it is necessary to carry only fourteen of these rods to this point, starting the fourteen 1⅛-in. round rods in the second story column at a point 14 in. above the second floor and extending upward. The loss incurred by carrying the entire twenty 1⅛-in. round rods into the second story column is about 24 ft. of 1⅛-in. round rod, which at 5 cents per lb. is about $4, as against the loss of $3 when no wall beam is designed to be poured with the floor slab. Wastes of this nature at the present high price of reinforcement are serious.

In the design of wall columns it will be necessary, usually, to consider the amount of sash and curtain wall required to fill the space between columns, as the smaller the width of the exterior columns the more sash and curtain wall will be required to fill in the space between these columns. This may seem trivial, but it will oftentimes give false impressions of economy if all these seemingly trivial details are not given a place in the estimated comparative costs of the various designs.

Illustration of the methods of determining the economical interior column are given below. It may be well to add that no attempt is made to consider any of the various methods of concrete design from an engineering standpoint. This paper is not intended to be a text on design in any form, but rather it is intended to present to the designing engineer a method by which he can solve for himself the question of economy in his work. Hence, the reader should study the examples given here with a view to applying the methods of cost calculation to his work and not draw engineering conclusions from any of these illustrative costs.

Several comparative designs for any interior column (Fig. 1) are shown here. The comparative costs of the various schemes are worked out in detail, using unit prices principally from tabulations in Part 1 of this paper. (See Contract Record of Aug. 21, p. 659).

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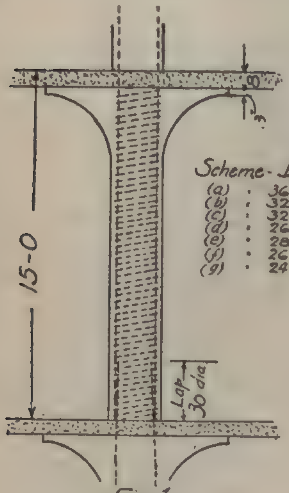
* Aberthaw Construction Co., before American Concrete Institute.

TABLE I.

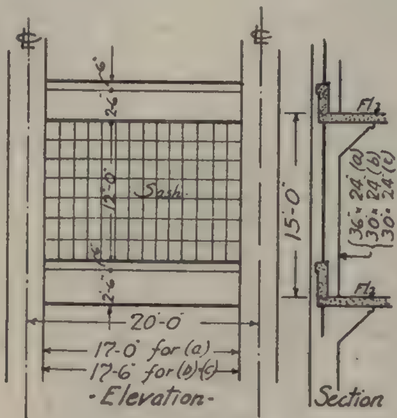
	Design.	Comparative Estimates		
Scheme (a)	36-in. dia. col.	Conc	99 cu ft at 34c	$33.66
	11 1⅛-in. rd. vert. rods.	Forms	Round steel	15.00
	⅜-in. rd. bands 12 in. o/c	Reinfct	716 lb. at 5c	35.80
	Mix 1 : 2 : 4	Lost fl. space	5 sq ft at $2.75	13.75
		Total		$98.21
Scheme (b)	32-in. dia col.	Conc	79 cu ft at 34c	$26.86
	23 1⅛-in rd. vert. rods	Forms	Round stel	15.00
	⅜-in. rd. bands 12 in. o/c.	Reinfct	1,437 lb. at 5c	71.85
	Mix 1 : 2 : 4	Lost fl. space	3 1-10 sq. ft. at $2.75	8.54
		Total		$122.25
Scheme (c)	32-in. dia. col.	Conc	79 cu. ft. at 36½c	$28.84
	12 1⅛-in. rd. vert. rods	Forms	Round steel	15.00
	⅜-in. rd. bands 12 in. o/c.	Reinfct	770 lb. at 5c	38.50
	Mix 1 : 1 : 1 2-3.	Lost fl. space	3 1-10 sq. ft. at $2.75	8.53
		Total		$90.87
Scheme (d)	26-in. dia. col.	Conc	52 cu. ft. at 36½c	$18.98
	11 1-in, rd. vert. rods	Forms	Round steel	15.00
	1 per cent spirals (18½ lb.)	Reinfct (vert.)	514 lb. at 5c	25.70
	per lin. ft.	Spirals	264 lb. at 5½c	14.52
	Mix 1 : 1½ : 3	Lost fl. space	7-10 sq. ft. at $2.75	1.92
		Total		$76.12
Scheme (e)	28-in. dia. col.	Conc	60½ cu ft at 43c	$26.02
	20 1⅛-in. rd. vert. rods	Forms	Round steel	15.00
	⅜-in. rd. bands 12 in. o/c.	Reinfct	1,255 lb at 5c	62.75
	Mix 1 : 1 : 2	Lost fl. space	1.45 sq. ft. at $2.75	3.99
		Total		$107.76
Scheme (f)	26-in. dia. col.	Conc	52 cu ft. at 43c	$22.36
	7 ⅞-in. rd. vert. rods	Forms	Round steel	15.00
	1 per cent spirals (18½ lb.)	Reinfct	245 lb. at 5c	12.25
	per lin. ft.	Spirals	264 lb. at 5½c	14.52
	Mix 1 : 1 : 2	Lost fl. space	7-10 sq. ft. at $2.75	1.92
		Total		$66.05
Scheme (g)	24-in. dia. col.	Conc	44½ cu. ft. at 43c	$19.14
	10 1⅛-in. rd. vert. rods	Forms	Round steel	15.00
	1 per cent spirals (16 lb.)	Reinfct (vert.)	606 lb. at 5c	30.30
	per lin. ft.	Spirals	229 lb. at 5½c	12.60
	Mix 1 : 1 : 2			
		Total		$77.04

From the above estimated comparative costs, perhaps the most noticeable fact is that the columns using the 1 : 2 : 4 mix of concrete are among the most expensive. Using this lean mix necessarily produces a column larger in diameter which means, also, a loss of valuable floor space. It will also be noticed that the smallest column designed is not the most economical. The column which shows the most economy in this case is one having a 1 : 1 : 2 mix and about 1 per cent. of vertical reinforcement together with 1 per cent. of spiral reinforcement. Hence a rich mix of concrete and comparatively small percentages of steel reinforcement seem to show the most economical results for a column carrying a fairly heavy load.

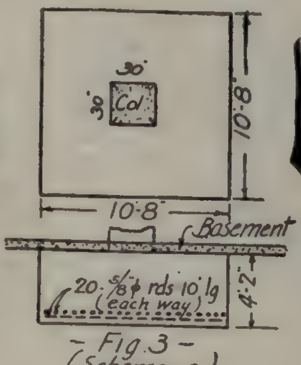
For comparative purposes, the difference in the amount of concrete in the column heads may be neglected as the top diameter of the head usually remains the same throughout the building. The cost of forming the column and its head has been estimated here at $15 each. This is done for convenience in arriving at a total cost of the column shaft. Ordinarily this is neglected in making comparative estimates of interior round columns, as it costs about the same to form a round column of small diameter as it does a column of larger diameter. Many other schemes may be designed for this particular column and the comparative costs estimated. However, these several examples, some of which are obviously too expensive to consider, will suffice to give the reader a working knowledge of the methods of calculation employed to determine the costs of the various types of interior columns. It is readily appreciated that even though a larger column were somewhat cheaper to build, the additional floor space occupied by this larger column might be worth more to the owner of the building than he would save in the construction of the column. Hence it becomes necessary to consider the value of this additional floor space as a part of the cost of this larger column. It is difficult to say what this floor space is really worth. However, a satisfactory way to deal with the situation is to consider the smallest column designed as a basis to which the other columns are to be compared. In the above illustration this column is 24 in. in diameter. Consider the area of floor space occupied by a column equal to the square of the diameter of the column. The additional area occupied by any one of these larger columns is equal to the difference of the square of the diameter of the column in question and the square of the diameter of the smallest column designed. This additional or lost floor area is priced at a unit cost equal to the approximate unit cost per square foot of floor space of the completed building including heating, lighting, sprinkles, etc. The unit cost per square foot of building is calculated by dividing the approximate total cost of the building by the number of square feet of floor space in the building, measurements to be taken "out to out" of the floor plan. For example, a building 200 x 6 ft. and five stories high may cost $165,000 complete. This works out at $2.75 per sq. ft. and for general purposes this will give fairly accurate results for the purpose described above.



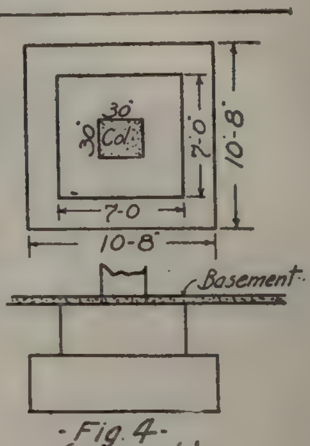
- Fig 1 -



- Fig 2 -



- Fig 3 -
(Scheme - a)



- Fig 4 -
(Scheme - b)

In the comparative estimates of the interior column (Fig. 1) given, if we strike out of each estimate the cost of lost floor space, the relative cost of each column will remain unchanged. This is not always the case, and even in our examples it will be noticed that the columns having the leaner mixes show up much more favorably when this item of cost is excluded from the total cost of the column. Frequently, the omission of this item will result in a transposition of the economic order of the various designs. In many buildings the loss of a few feet of floor space is immaterial, but in other cases it is of great importance, as in storehouses or in buildings where the machinery layout would be interfered with by a larger column. Where loft buildings or offices are rented by the square foot of net area the cost of this floor space should be figured at a considerably higher figure than the one given in our tables.

In determining the economical wall column, the method is very similar to that used for interior columns except that the item of the cost of wood forms enters into the estimate. It will be necessary also in designing exterior columns to consider the width carefully, as every inch added or deducted to the width of the column will change the corresponding dimension of wall sash a like amount.

Consideration is given below to the economical design of a typical wall column (Fig. 2) for a concrete building having these columns spaced 20 ft. on centres. For lack of space only three designs will be compared here, but the principles are clearly illustrated and further designs should be treated in a like manner.

The cost of each wall column design includes the cost of sash and glass together with the curtain wall necessary to fill in one bay. For convenience in making these estimates, it is assumed the glass is factory ribbed glass costing 20 cents per sq. ft., including glazing. Steel sash is estimated here at 25 cents per sq.

TABLE TWO

Scheme (a)	36 x 24 in. 12 ⅛-in. rd. rods 17 ft. 6 in. ⅜-in. rd. bands 12 in. o/c	Conc	86 cu. ft. at 34c	$29.24
		Forms	143 sq. ft. at 15c	21.45
		Reinfct	777 lb. at 5c	38.85
		Curtain walls	31 sq. ft. at 75c	23.25
		Window sill	17 lin. ft. at 60c	10.20
		Sash and glass	204 sq. ft. at 45c	91.80
		Total		$214.79
Scheme (b)	30 x 24 in. 10 1⅛-in rd. rods 17 ft. 10 in. ⅜-in. bands 12 in. o/c Mix 1 : 1½ : 3	Conc	71 2-3 cu. ft. at 36½c	$26.16
		Forms	129 sq. ft. at 15c	19.35
		Reinfct	651 lb. at 5c	32.55
		Curtain wall	32 sq. ft. at 75c	24.00
		Window sill	17½ lin. ft. at 60c	10.50
		Sash and glass	210 sq. ft. at 45c	94.50
		Total		$207.06
Scheme (c)	30 x 22 in. 12 ⅞-in. rd rods 17 ft. 2 in. ⅜-in. rd. bands 12 o/c Mix 1 : 1 : 2	Conc	46 cu. ft. at 43c	$19.78
		Forms	124 sq. ft. at 15c	18.60
		Reinfct	460 lb. at 5c	23.00
		Curtain wall	32 sq. ft. at 75c	24.00
		Window sill	17½ lin. ft. at 60c	10.50
		Sash and glass	210 sq. ft. at 45c	94.50
		Total		$190.38

ft., erected and pointed, making a total of 45 cents per sq. ft. for the sash and glass in place. The curtain wall below the sash is figured here at 75 cents per sq. ft. In making the sketches of the exterior wall bay for estimate purposes, no care has been exercised to select stock sizes of steel wall sash. In actual practice, however, this is usually of prime importance. The cost of the extra floor space occupied by the larger wall column has not been considered here as its influence on these particular columns would be negligible.

In the design of concrete footings it often happens that it is difficult to decide offhand whether a plain or reinforced concrete footing should be used. A design of each type of footing should be made and the comparative costs calculated. The engineer knowing the kind of soil these footings will rest upon should price the excavation required at a proper figure. This is a very important part of the footing cost, in fact, many times the most vital part of the estimate for foundation work. In the absence of any more reliable information the unit costs of excavation per cubic yard (not over 5 ft. deep) may be assumed as follows:

Loam or other easy excavation	$0.75 cu. yd.
Gravelly earth containing small stones	$1.00- $1.50 cu. yd.
Frozen earth	2.25- 2.50 cu. ft.
Rock or ledge excavation	3.50- 4.00 cu. yd.
Backfill	.10 sq ft.

For excavation work over 5 ft. deep and down to 10 ft. deep, the unit cost on the yardage below the 5 ft. depth should be increased approximately 50 per cent. An example is given below with comparative costs for the two types of footings, reinforced and plain, shown in Fig. 3 and Fig. 4, respectively. The excavation is assumed as costing $1 per cu. yd. to remove, and the excavated holes are sheeted close in order to do away with form work around the large footing block.

Table Three

Scheme (a) Reinforced type (mix 1 : 2 : 4)	Conc	460 cu. ft. at 34c	$156.40
	Forms (none).		
	Reinforcement	420 lb. at 5c	21.00
	Excavation	19¼ cu. yd. at $1.00	19.25
	Back fill and level	19¼ cu. yd. at 30c	5.78
	3-in. sheeting (close)	182 sq. ft. at 10c	18.20
	Total		$220.63
Scheme (b) Plain type	Concrete 1 : 2½ : 5	507 cu. ft. at 32c	$162.24
	Forms (top block)	84 sq. ft. at 15c	12.60
	Excavation	24 cu. yd. at $1.00	24.00
	Excavation below 5 ft. mark	5½ cu. yd. at $1.50	8.25
	Backfill and level	29½ cu. yd. at 30c	8.85
	3-in. sheeting (close)	270 sq. ft. at 10c	27.00
	Total		$242.94

As above shown, the reinforced footing is the most economical to use in this case. However, provided stones or "plums" were obtainable at a small expense, the cost of the plain footing could be considerably reduced. It will be noted in the estimates for these two footings that the excavation for the plain footing is the determining factor in its cost. The materials used in the plain footing cost somewhat less than those used in the reinforced type, but the extra depth of the excavation makes the plain type the more expensive one to use. This extra cost becomes still greater when the unit cost of digging increases. In case the reinforced type of footing is built with a sloping top, and a wood form is used for this top, the cost would be about the same as though the concrete were poured up to a level with the top of the footing, and the form work omitted, as above estimated. In some operations the top part of a footing is sloped and the concrete poured "dry". This necessitates a change in the batch, slows up operations and many times does not work out economically. For estimating comparative costs of footings it is not a safe procedure to assume that the top part of the footing will be poured "dry" in order to do away with forms on the slope. Either estimate a form for this sloping surface or figure on the concrete as being poured up to a level with the top of the footing.

It has been previously stated that in the design of the beam and girder type floor, the omission or addition of one intermediate beam per bay may influence the cost materially. Although this problem is usually handled economically by engineers designing concrete buildings which have usual floor loadings and column spacings, it sometimes happens that when unusual floor loadings and column spacings are required, it is necessary for the engineer to determine a layout which will show the most eceonomy. In a propostion of this kind it is first necessary to make the design which looks most likely to be the economical one. Then, two more designs should be made, one having one more intermediate beam and the other having one less intermediate beam. Sometimes the girders should be run in other ways and designs made on layouts entirely dissimilar. Cost comparisons made of these designs will show conclusively which system should be adopted.

For the purpose of illustrating the methods of estimating beam and girder floors with a view to economy, the two schemes shown in Fig. 5 and Fig 6, designed for the same column spacings and live loads, are estimated here in a comparative way. Only these two layouts are compared here, but other layouts should be estimated in a similar manner, bearing in mind that the more beams and girders in the floor the more expensive the form work becomes.

In scaling the quantities for the comparative estimates of these two designs, it will be necessary to include all the concrete forms and steel reinforcement in one 18-foot bay for the full width of the building, which is about 67 ft. 6 in. In Fig. 5 the quantities will include the slab over one complete bay, 7 intermediate beams, 2 wall beams and 4 girders. In Fig. 6, the corresponding quantities will include the slab over one complete bay, 11 intermediate beams, 2 wall beams and 4 girders. Below under the head of "Estimate, Fig. 5" and "Estimate, Fig. 6" will be found these respective quantities to which unit prices have been fixed (a list of which will be found in Part 1), and the total comparative cost of one bay for each scheme estimated.

Estimate, Fig. 5.

Concrete, 825 cu. ft. at 34c	$280.50
Forms, 1860 sq. ft. at 13c	241.80
Reinfct., 7,300 lb. at 5c	367.00
Total	887.30

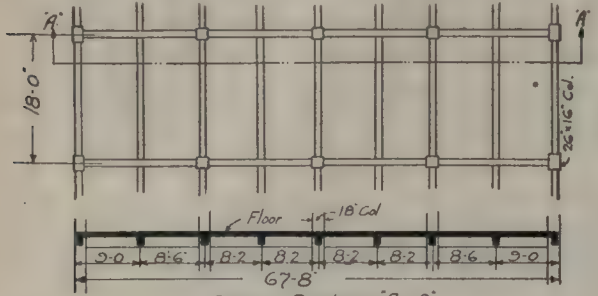
(Unit cost, 73 cents sq. ft. of floor.)

Estimate, Fig. 6.

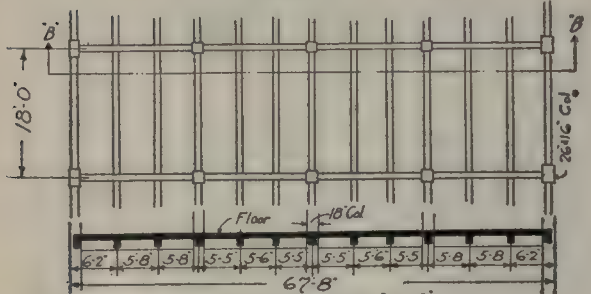
Concrete, 700 cu. ft. at 34c	$238.00
Forms, 2,000 sq. ft. at 14c	280.00
Reinfct., 6,300 lb. at 5c	315.00
Total	833.00

(Unit cost 68½ cents sq. ft. of floor.)

In "scaling off" the quantities for comparative estimates of beam and girder type floor, care must be taken to carefully consider the laps in the reinforcement. All steel reinforcement actually occurring in the slab and beams should be estimated. In taking off the quantities, also, it will be found most convenient to first get the quantity of concrete, then the square feet of forms, and lastly the pounds of reinforcement. The order of scaling for the form work and reinforcement should be the same as that followed in getting the quantity of concrete, that is, if beams follow slabs in the concrete scaling, beam steel should follow slab steel in the reinforcement scaling. This method will eliminate to a large extent the liability of error, and also lessen the work of scaling dimensions since the form areas may be taken directly from the scaled dimensions of the concrete work.



Cross Section "A-A"
- FIG 5



Cross Section "B-B"
FIG. 6

The slight changes in column and footing design which might actually occur in two buildings designed with floors like those above estimated, have not been considered here as the details of column and footing costs are treated elsewhere. However, in buildings several stories in height this phase of the design should be carefully considered in conjunction with the cost of floor designs when the cost comparisons are made. Even though the spacing of columns remains the same for all schemes considered, the different dead loads may influence the cost of the columns and footings considerably and the different girder depths may make it possible to vary the over-all height of the columns in order to get the same clear head room.

Concrete Roof Specifications

Recommendations of a concrete roof specification are made by the Sandusky Cement Company, in which special attention is given to the aggregates, reinforcing, expansion joints and curing, to assist in meeting the severe atmospheric conditions to which the roofs are subjected. The suggestions are as follows:

Aggregates.—Carefully selected sands, fine to coarse, showing not over 30 per cent. voids (when dry) by water. Water must be replaced by the cement, plus 10 per cent. Should 1 part water fail to fill 3 parts dry sand (by measure), then less sand must be used.

For the larger aggregate, ½ to 1-inch gravel will give the greater density, and if hard to obtain, use 1-inch trap rock. Determine voids, and replace water with the sand, plus 10 per cent.

Reinforcing—Rods or heavy wire mesh should be of high quality, showing maximum strength at a minimum size.

Waterproofing.—Use 8 pounds Medusa waterproofing powder, or 1 gallon (8 pounds) Medusa waterproofing paste, to every barrel of regular portland cement.

Thoroughly mix the powder with the dry cement before adding sand. First mix paste with equal parts water, later adding 19 parts water, making solution 1 to 20, based on dry sand. Bank run or pit sands often contain a third of the amount of water necessary to fill the voids, in which case the solution must be made 1 to 15.

Mix—One part Medusa waterproofed portland cement (or use ordinary portland cement and Medusa waterproofing), 4 parts gravel or trap rock, 3 parts sand. Change according to voids found after testing aggregates as suggested.

The leaner the mix, providing all voids are filled with the cement and sand, the less liable are cracks to develop. Mix should be sufficiently stiff to hold all aggregates in suspension when placing.

Gutters, Corners and Edges—Should be covered with Clinton or other fine wire cloth, well secured to side walls. Plaster with a 1 to 2 cement mortar directly ahead of roof mix.

Laying.—Distribute mix evenly with shovel (not dump in spots with wheelbarrow or bucket). This avoids excess of fine material in certain places and uneven action when curing and troweling. Strike off, tamp well, giving special attention to corners and edges. Steel trowel to a finish, avoiding excess troweling which causes hair-cracks.

Thickness.—Slabs should be from 3 to 6 inches thick, depending on size of roof. This also determines size and method of reinforcing. Concrete slabs of carefully mixed materials, properly reinforced, 6 inches thick, are safe in 20-foot squares. Thinner slabs should be smaller in size.

Joints.—Expansion joints should be made with division plates, the thickness of slab. First lay pencil rods 6 inches apart with slope of roof. Cover with strip of best quality tarred felt, folding center up near to height of slab with face toward section about to be poured, and back with division plate.

Munition Plant Rebuilt without Hindering Production

THE Atlantic Ave., Toronto, plant of the British Forgings, Ltd., is, like all other munition plants to-day, a hive of industry. The magnitude of the output of this plant is inconceivable unless one is permitted to view operations from the inside, a favor that should not be lightly appreciated.

We are all more or less familiar with the work of the efficiency engineer. The munition field has demanded the maximum limit of efficiency and has tested the ability of the experts engaged in this work to their utmost capacity. Operations have been studied so carefully that no expense is spared in the installation of equipment that will reduce the time on any operation by seconds. When it is realized that a saving of two or three seconds on one operation means an increase of hundreds in the day's output of shells, the importance of the time saving is quite evident.

This plant started operations in March of last year, but it was not until October that the organization became the smooth running machine it is to-day. The daily output is now between 5,000 and 6,000 six-inch shells a day. To date this company have turned out over 1,250,000 six-nch shells, which is splendid evidence of the efficiency and driving power of the executive staff responsible for these results. To produce this output 494 tons of steel are used each day and the daily consumption of fuel oil for the furnaces is 7,000 gals.

For some time, as might be expected, the company have been inconvenienced by lack of shop space. Industries of this kind develop so rapidly that it is very difficult to make provision for future requirements in plant etxensions. It finally became evident that expansion was imperative and the company were faced with the problem of building without disturbing the operation of the plant, and at the same time securing for themselves larger quarters without loss of time. The difficulties to be faced were:

(1) Work must not be stopped or interfered with in any way.

(2) The building must be of a type that could be erected quickly.

(3) The present lay-out must be utilized owing to loss of time necessitated by any change.

(4) Any building erected must comply with the building requirements of the city of Toronto.

A study of the situation determined the fact that a skeleton steel frame building of sufficient size to be erected over the existing buildings was the most suitable type under the circumstances; but as delivery of structural steel from the mills is uncertain, due to the heavy load placed on them all to supply war material, the steel must be secured elsewhere. A careful search was instituted and a suitable building, steel frame, 150 ft. x 250 ft. was found standing empty in a small town up on Lake Huron. The building had a centre span of 72 ft. carried on 8 in. columns, and on each side of this centre span was a lean-to wing of about 38 ft., as shown in Fig. 2 of the illustration. It was decided to purchase this building, take it down and move it to Toronto, to be erected on the company's property.

The existing buildings in Toronto are shown by dotted lines in Fig. 1. Over this will be erected, without interference with the factory output, the main section of the purchased building and one lean-to wing, as shown. The smaller biulding on the right of Fig. 1 will be retained and the other lean-to is to be assembled as shown in Fig. 3, into a separate building 125 ft. long, simply by putting a row of columns up the centre. As can be readily seen the new building is far better lighted and has much more overhead space and being almost double the length of the old buildings, will give much greater floor space.

Levels were taken, lines run, and the concrete column footings placed without interfering in any way with the work of the plant. Steel sash is to be used throughout and the maximum light possible secured. The building will be sheeted with galvanized iron.

When the new building is erected the walls and roof of the existing buildings will be removed and the plant and equipment extension made where required.

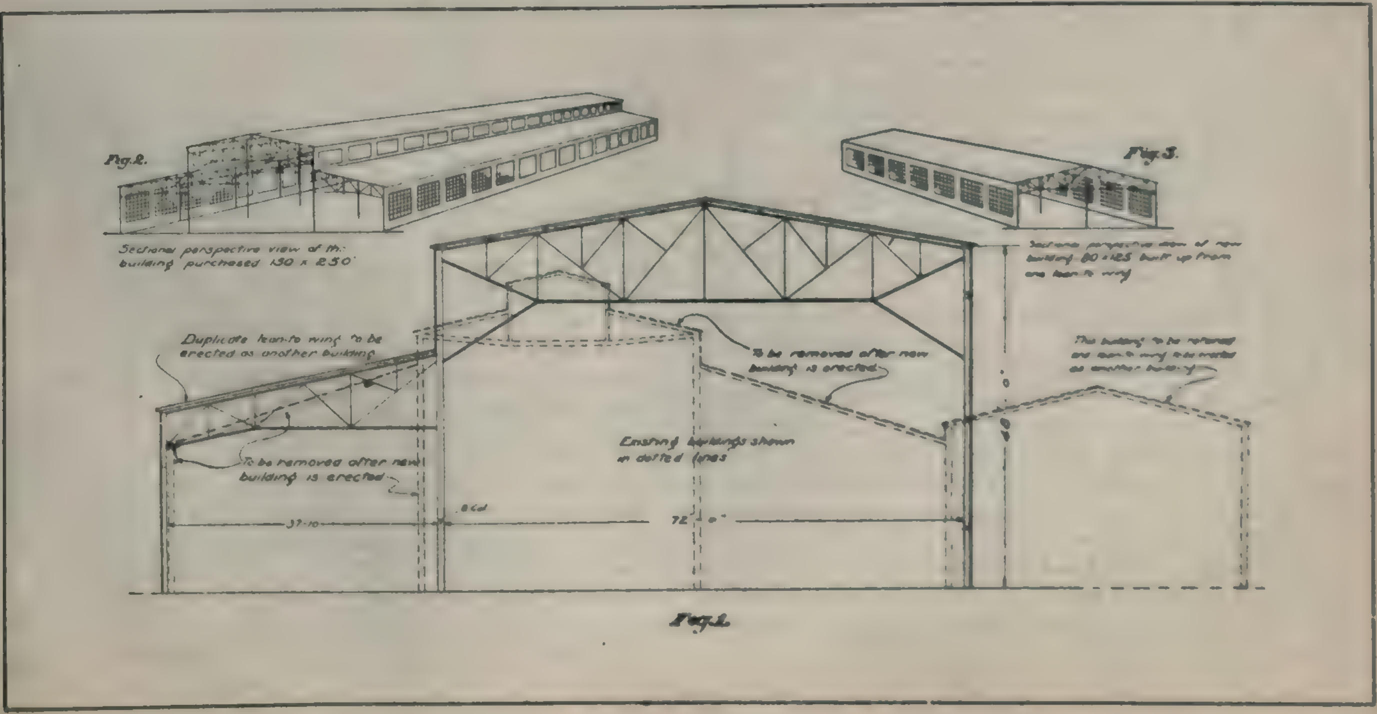


Fig. 2.
Sectional perspective view of the building purchased 150 x 250'
Fig. 3.
Sectional perspective view of new building 80 x 125 built up from one lean-to wing
Duplicate lean-to wing to be erected as another building
To be removed after new building is erected
To be removed after new building is erected
This building to be retained and lean-to wing to be erected as another building
Existing buildings shown in dotted lines
8 Col
37-10
72' 0"
Fig. 1.

Methods of Making Sewer Pipe Joints

In a recent discussion before the Sanitary section of the Boston Society of Civil Engineers much interesting information was brought out on the various methods of making joints in sewer pipe. The following experiences of Metcalf & Eddy, consulting engineers, with poured joints is of interest.—Prior to 1907, Metcalf & Eddy specified cement mortar joints for vitrified pipe in separate sewers as well as storm drains, but since that year some form of poured joint has been generally used in their practice, where it was essential to keep out ground water.

The cement mortar joints are now specified as follows:

> The joints shall be as nearly water-tight as possible, and shall be made with a gasket of hemp or jute and cement mortar composed of one part of sand and one part of Portland cement. The gasket shall be soaked in a satisfactory mixture of neat Portland cement and water and then inserted between the bell and spigot and carefully calked into place with suitable calking tools. The gasket shall be in one continuous piece for each point and of such thickness as will bring the pipe to the required relative position. The remainder of the joint shall be filled with cement mortar applied with the hands, protected with rubber mittens, well pressed and calked into place, after which the joint shall be beveled off with mortar for a distance of two inches from the outer edge of the bell. The joint shall be wrapped in unbleached cotton cloth, securely tied to prevent the mortar from slipping or being otherwise injured. No surplus mortar or other foreign substance shall project into the pipes from the joints, and if necessary, they shall be properly cleaned with a suitable scraper or by other means before the mortar becomes hardened.

It has been found difficult on contract work, to get sufficiently water-tight joints in this manner, although the use of cheesecloth for wrapping the joints was of value in preventing the bottom of the joint from falling off.

A mixture of sulphur and sand—using equal parts by volume of flour or sulphur and very fine sand—was used on several contracts. Unless the sand is very fine and practically free from clay the resulting joint is apt to shrink on cooling, causing objectionable cracks. Further, the sand, if too coarse, tends to settle out of the mixture, causing trouble in pouring and shrinkage of the joint. Some very successful work, however, has been done with this material. It appears to require more care in heating than some other mixtures. The chief difficulty has been to get a satisfactory mixture, due almost entirely to the size and quality of the sand. On contract work, this is a disadvantage. The joint, also, is absolutely rigid, as is the case with cement mortar.

When using sulphur-sand joints, the joint, after being poured and while warm, was coated with hot tar as a further precaution against leakage.

During the last few years, a number of compounds for jointing vitrified pipe have been placed on the market. Since 1913, Metcalf & Eddy have used that known as G-K compound, now made by the Atlas Co. of Lincoln, N.J. This material, said to be made largely of vulcanized linseed oil and clay, resembles vulcanized rubber or coal tar in appearance. It is easily melted by heating in an iron kettle over a fire, preferably using gasoline or kerosene, so that the heat may be controlled.

Specifications for making this form of joint as well as sulphur-sand, are as follows:

> Where plastic joints are specified, the pipe shall be laid as previously specified, and the joints shall be thoroughly calked with a gasket of hemp or jute in one continuous piece, and of such thickness as will bring the pipes to the required relative position. The gaskets shall be calked dry and shall form a water-tight joint. The plastic compound to be used in jointing the pipes shall be that known as——compound, manufactured by——, or other plastic jointing material satisfactory to the engineer. The compound shall be heated in a gasoline or other suitable furnace, to a temperature slightly above that at which it will pour rapidly and smoothly; at which it shall be kept until used. After the pipe joint has been calked, the melted compound shall be poured into the joints by the use of a joint runner or gasket, in a similar manner as lead joints are poured. In case the pipe joint is not completely filled, that part of the joint shall be poured again with hot material, to form a complete water-tight joint. Wherever permitted, sections composed of two or three pipes may be jointed at the side of the trench, provided the pipes are set in a suitable wooden cradle to ensure true alignment. In lowering sections, so made, into the trench, a piece of timber shall be run through the pipes in order to support their weight and prevent the joints or bells from being broken.

Asphalt has not been used, or any of the bituminous compounds, to any extent, because of the danger of hot water or steam melting out the joint due to the low melting points of most of these materials. With a sufficiently high melting point, this objection would be covered.

Some trouble has been experienced during cold weather with G-K compound, due to its failure to stick to the pipes, especially in the smaller sizes where the inside of the bell is glazed and there are no scorings.

From tests made both in the laboratory and on contract and day labor work, the results obtained with G-K compound have been satisfactory.

The cost of a jointing material and labor will be from 50 per cent. to 100 per cent. more with a poured joint than with cement, judging by average prices received. Part of this excess cost is doubtless due to the unfamiliarity of contractors in general with poured joints for vitrified pipe.

Sheet metal forms and gaskets for pouring cement grout joints have recently been placed on the market by Mr. L. A. Weston, of Adams, Mass. The writer understands that the price of the gasket is 10 ct. for a 10-in. pipe and 10 ct. for the form, thus making a cost of 20 ct. per joint for the form and gasket. The gasket, of course, is left in place, and it would appear probable that the form, also, would be left in place, as a rule. The gasket is made to fit over the spigot end of the pipe, being tightened with a screw driver. The notches in the edge are pliable so that the gasket adjusts itself to the inequalities in the pipe hub. No jute is required.

The form provides for pouring the lower half of the joint, the remainder being filled by hand with cement mortar. The form is held in place by wires.

In order to offset the expense of the form and gasket, a material saving in labor cost must be made in addition to the saving in cost of materials over poured joints using other materials than cement.

This firm believes that poured joint is the most desirable form of joint yet devised where it is essential to prevent the entrance of roots and ground water. Good results have been obtained with a sulphur-sand mixture, with bituminous compounds.

On contract work, these commercial compounds may have some advantages from the contractor's viewpoint.

On account of the imperfections in the so-called "standard" socket sewer pipe it is almost necessary to use "deep and wide" socket pipe if poured joints are to be adopted. Otherwise there is liable to be insufficient space for the flow of the jointing material-

Coal Conservation in Fact

By C. R. Knowles

IN times of stress like the present, when conservation is the great watchword of the day; when the nation has begun to realize the enormous wastes of time and materials which is going on and has been going on for years; when every bit of energy has to be put forth to save in every possible way, the fuel problem looms up as one of the important if not possibly the most important one for present consideration.

In no one way has there been and is there greater waste than in the use of fuel for domestic and manufacturing purposes.

In domestic uses there is hardly an attempt made to obtain anything like efficiency of fuel consumption; the apparatus in the vast majority of cases is inefficient, poorly designed and installed, and the people who have to operate such apparatus are either poorly informed as to the proper way to do so are careless and lacking in incentive to obtain the best results.

There are thousands of domestic heating installations where the fuel losses through the furnace grate are not less than 25 per cent. and very many where the percentage of loss runs as high as 50 per cent. In manufacturing uses it is safe to say that the great majority of boiler furnaces have an efficiency of fuel conversion of less than 50 per cent. and when it is considered how vast is the number of varied manufacturing industries, these losses run into astoundingly large figures.

Under present war conditions and the unusually severe weather conditions of the past winter, the fuel shortage became most acute and the public then realized, if never before, the great necessity for an ample fuel supply, and various expedients, such as the limiting or the denying of the fuel supply to various industries deemed by the Government as, for the time being, nonessential; the elimination of the excessive use of illuminants—gas and electricity—for display and other lighting purposes; the setting of the time ahead one hour to conserve daylight, and others, all more or less meritorious but temporary in character, have been and are being used.

Do Not Strike at the Root.

All such operations, while they undoubtedly help to tide over and enable a temporary control to be obtained over the existing critical conditions, do not strike at the root of the matter nor are they a remedy for the ever present vast fuel wastes which are continually going on 365 days in the year.

These wastes lay right with the consumer, who either does not know of them, or knowing, wilfully continues and makes no effort to reduce or eliminate them.

In an editorial in the Electrical Review, May 25, 1918, entitled, "The First Practical Step Toward Fuel Conservation," it is stated that the remedy for relieving the fuel famine such as occurred during the last winter and which is still with us, "lies in educating those responsible for the plants" consuming coal as a fuel, "as to how best to operate them and insist that they employ means and apparatus for doing it." Further, "those plants . . . should be regulated and their performance controlled by federal, state or civic authorities that the nation's coal supply be not needlessly and wantonly impoverished." "Civic departments for boiler inspection and smoke abatement and allied insurance interests should immediately operate with federal or state authorities to improve these plants where feasible."

It seems to the writer that the aim of every coal user should be to obtain the maximum of heat from a given weight of coal, use less and utilize more. To do this the users of fuel should be shown where their present methods of uitilization are faulty, where changes of apparatus could be made which would cause a betterment, what fuels are best for their use and the best forms in which to use them and how to operate their combustion apparatus with a minimum of cost and a maximum of output. Two points in this connection stand out most prominently; the character of the fuel tand its method of application.

Use of Lump Coal Not Economical.

It is undoubtedly true that the use of coal in lump form is not its best form of application, and that it is necessary to break up a fuel to such uniform size that the oxygen of the air can unite perfectly with it for combustion, and that the finer it is the more completely it can be oxidized and consumed. As early as 1881, Sir William Siemens said: "I am bold to go so far as to say I consider it barbarous to use coal for any purpose in its crude state and believe that the time will come when all crude fuel will be separated into its component parts before utilization."

A 1-inch cube of coal exposes but 6 square inches, 1-24 of a square foot, of surface area for absorbing oxygen and liberating heat, but when pulverized to a proper degree of fineness it will expose from 20 to 25 square feet of area—500 to 600 times as much area—for oxidation so that the finer the coal is divided the more complete will be the combustion.

That this is true is borne out by the enormous public use of the finer sizes of coal—pea, buckwheat and rice sizes—in furnaces properly equipped for their use and also indicates that ultimately the best and most economical use of coal is in its pulverized form, in which form practically complete and smokeless combustion takes place.

It also follows that the combustion apparatus must be of such a character as is best fitted for the form of fuel used, becoming simpler and more efficient in form the finer the subdivision of the fuel and reaching its ultimate of simplicity and efficiency when finely pulverized coal is used.

Gas or Near-Gas Fuel.

It is the opinion of the writer that the ultimate form of fuel to be used to obtain the best economic results is a gas or a near-gas fuel—gas for domestic use and pulverized coal for industrial uses. To arrive at such a desired condition of economical fuel utilization there is not the slightest doubt but that federal, state or civic control is necessary, otherwise substantial progress will not be made, because the great majority of fuel users will be satisfied to go on in the old way unless compelled to change, not alone for their own good but for the good of the great majority.

The question of smoke abatement is a fair example of such a condition. So long as there was no compelling authority to cause its stoppage, the public at large continued to make as much smoke as it pleased, regardless of its deleterious effects, but so soon as various states and cities enacted laws regulating its formation and said this nuisance must be stopped, a different condition of affairs came about and in very many places the smoke nuisance has been abated and eliminated, and the end is not yet.

The Snow Removal Problem

By George T. Donohue*

THE problem of snow removal in Chicago is a very complicated one. For instance, in the loop and in some of the business districts, all of the snow that falls on the sidewalks and streets must not only be cleared, but in addition, hauled away; while in the outlying districts and on practically most of our boulevards it is usually sufficient to clear the thoroughfare. When the snow must be removed, it can be piled in the adjacent parkways, thereby eliminating hauling.

To remove snow efficiently requires organization and proper equipment. In a good organization there should be a distinction between the snow "fighting" force and the snow "removal" force. Philadelphia and New York offer to us splendid examples of organization of this kind. In Philadelphia one engineer is in constant touch with the weather bureau. As soon as indications point to a continuance of the storm the snow fighting equipment is ordered out. Over 1,000 telephone messages are sent to squad leaders, foremen, snow plow drivers, laborers, etc. Attack is then begun with horse drawn and motor driven plows. Every man in this organization has a particular function assigned to him. As an example, every foreman knows his post at a certain dump, and knows exactly what to do when he gets there. The driver of every snow plow and of every team knows where he is to report and what point he is to start to load, and at what dump he is to deposit his load. As a result of this preparedness there is no confusion.

Snow Fighting

Experience has taught us that in fighting snow the best thing to do is to start when the snow begins to fall and work continuously, keeping abreast with the storm if we can. If we do not keep even with the storm and the snow becomes packed, the cost of doing the work is more than doubled. For snow fighting the horse drawn and motor driven plows under normal conditions have proved very effective. In Lincoln Park the experience has been that the horse plow should be pulled and the motor driven plow pushed. In the former case the abrasive action of the horses' hoofs helps to loosen and break up the snow, while in the latter case the snow is pushed to one side before the wheels can pass over and pack it down. The motor driven plow is by far the more efficient if it can be used before the snow is packed. After packing has taken place the motor driven plow has a tendency to ride over the packed portions, thereby not cleaning thoroughly. Under conditions of this kind slower but more effective work can be done by the horse drawn plows.

Snow Removal

Where snow has to be removed after being plowed, dump wagons and dump trucks are usually used to haul the material to the disposal stations. In Chicago, very effective use has been made of the lake and river for disposal purposes. In New York and St. Louis considerable use is made of sewers for carrying off the snow. Especially constructed manholes having large removable sectional covers are built and provided with water jets having a pressure of 25-30 lbs. Where sewers are 2 ft. and over in diameter, this method has given very good results.

The method of snow fighting and removal referred to covers the ordinary working conditions. The snow falls of January and February, 1918, were of such frequency and intensity that the usual methods of attack and removal had to be abandoned. In the January storm there was no chance to keep ahead of the snow. Motor driven plows sent out on the boulevards got stuck in the drifts and had to be hauled out with teams. The problem soon developed into one of snow removal entirely. The official government records show that 9 inches of snow fell in December—42.5 inches in January and 8.4 inches in February, making a total for three months of 59.9 inches. On many of our boulevards we encountered drifts from 6 to 7 feet high. Where 6 and 7 feet cuts are met they are out of the range of ordinary plow and scraper work. A steam shovel or drag line would be a more appropriate piece of machinery to handle a cut of this size. Milwaukee was driven to the use of a steam shovel. On some of the narrow streets with car lines in this city there was absolutely no place left between the car tracks and the curb to place additional snow. Two steam shovels working nights were set to work loading snow into flat cars which were subsequently dumped into the river. The average cut on this work was between five and six feet. The dippers on these shovels were of the usual earth digging type. After watching them work for some time it was very evident that specially constructed dippers with larger capacity would have given a much larger output. In Lincoln Park we were not fortunate enough to have a steam shovel available for work. If we had had, I am sure we could have used it to great advantage. We were unable to get through the drifts with either our horse-drawn or motor-driven plows. As the plows went out of commission hand shoveling was the only resort left to open up the pioneer cut. In some cases the snow was cast aside and wasted, in others loaded directly into wagons. After this cut was made we brought into service on the boulevards a piece of equipment that we ordinarily use only when cleaning the skating ponds. It is a form of slip scraper made of wood and shod with iron. When fully loaded it has a capacity of more than ½ yd. The snow was gathered from the boulevards, hauled a short distance, and then dumped clear of the road. For the park problem this scraper was very efficient. Following the slip scrapers there was a battery of from three to five horse-drawn blade scrapers that pushed the snow towards the curb.. Where it was possible these scrapers straddled the windrow left by the machine ahead. After the horse-drawn scrapers had done their work, the motor-driven plows followed them and made the finished cut. The outlined procedure was the one usually followed. In many cases it had to be altered to fit special conditions. The one outstanding feature in handling the February snowstorm was that it was necessary to reverse the usual method of procedure, sending the plows over last instead of first, and using the shovellers to open the path instead of trimming up after the path had been opened by the plows.

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*Before Western Society of Engineers, Lincoln Park, Chicago

Grouped vs. Detached Houses

IN a recent bulletin issued by the Ontario Housing Committee, which we reprint below, the advantages of group houses and detached houses are outlined for comparison. It is noticeable that one of the advantages claimed for detached houses is greater privacy. This, however, would seem to depend on the size of the lot. Those who have lived in the typical, speculator-built, semi-detached house, where as a rule, in the interests of conservation, an alleyway of about 2 ft., more or less, is provided between separate buildings, will probably agree that the party-wall admits of less unintentional intercourse with the neighbours than do the open windows facing each other on the detached side. This, of course, is apart from the question of community lawns or playgrounds. However, in his recent address before the Ontario Municipal Association, Premier Hearst stated that no loans would be allowed on lots of less than 25 x 100 ft., and then only when the lot was previously in possession of the owner; lots acquired after obtaining the loan must not be less than 30 x 100 ft. No doubt this idea of greater space is correct, but the average six-room house in the city of Toronto at the present time has no such width of frontage, and the average owner of this type of house would be unable to bear either the initial purchase price or the resultant greater taxes.

The Advantages of Group Houses Compared with the Advantages of Detached Houses.

"A strong feeling exists in the minds of most Canadians in favor of the detached house as opposed to groups of houses. Undoubtedly, the detached house has advantages, but the house which is one of a wisely designed group has also certain advantages. These advantages are not confined to congested areas where land values do not permit of large lots, but apply to a degree in all communities. However, the greater the congestion, the stronger the case becomes for the proper grouping of houses.

"The advantages of detached houses are:

1. Greater privacy—a feature which appeals very strongly to Canadians, with their marked individualism.
2. Greater air space immediately around the house.
3. Better lighting facilities, especially in a large house.
4. Less danger from fire.

The following are the advantages from grouping:

1. Saving in cost of construction because of party wall.
2. Saving in heating through reduced exposure.
3. Saving in expense of paving, as shown in the diagram. The paths to the playground need only be of gravel.
4. More play space, since the inadequate spaces between the houses are brought together into one large plot.
5. Greater opportunity for architectural effect, since greater variety is possible in a large building or a group of houses than in a number of small houses.
6. The fostering of the community spirit, without any great sacrifice of privacy.

"Whether the advantages of grouping are sufficient to outweigh the disadvantages must be left to the judgment of the individual and the municipality. It will be seen that they are considerable, and it is undoubtedly a fact that they have not received sufficient attention owing to the entire disregard of the amenities in the unsightly terraces of our Canadian towns and cities."

Good Roads League of British Columbia

On Tuesday, Sept. 17, the Good Roads League of British Columbia will hold a convention in Penticton, just one day prior to the opening of the annual convention of the Union of British Columbia Municipalities, sessions of which will be held on the three following days. Secretary J. S. Heales is arranging the programme of the good roads' meeting, and has secured many prominent men as speakers. Hon. Dr. King, minister of public works in the provincial government, will give an address on "The Government's Policy in Connection with Good Roads"; Mayor Gale of Vancouver will speak on "Closer Relationship and Greater Co-operation between the Centres of Population and Outlying Districts"; Mr. J. A. MacKelvie has chosen as his subject "Motoring Through the Okanagan Valley"; Mayor Todd of Victoria will tell "What the Pacific Highway Has Done for the Pacific Northwest"; and Mr. Ernest Waterman, president of the Princeton Coal & Land Co., will describe the scenic beauties viewed "While Motoring Through the Similkameen Districts." The Good Roads League of the State of Washington will also send a representative to attend the convention and address the delegates.

A New Aggregate for Concrete Ship Construction

The Emergency Fleet Corporation, according to reports sent out from Washington, has been experimenting with and developing the use of a concrete mixture by which concrete ships may be made lighter in weight and at the same time more durable. The numerous tests made establish the conclusion that ships made of the new concrete mixture will be 20 per cent. lighter than those made of wood, and that they will be double the strength of those made of concrete of the ordinary mixture. Another claim being made for the new process is that ships constructed in accordance therewith will have a greater length of life than steel ships. It is a understood that the plan contemplates using the new mixture to apply a protective coating to concrete ships already under construction, to increase their durability and enhance their capacity to resist impact. The ingredients in combination to make up the new aggregate are not given, although it is certain that an element of extreme lightness is introduced. The development of concrete ships, initiated principally as a war measure, will surely reach a standard of efficiency in war service, and thus their utility will be established for merchant-marine service after the war.

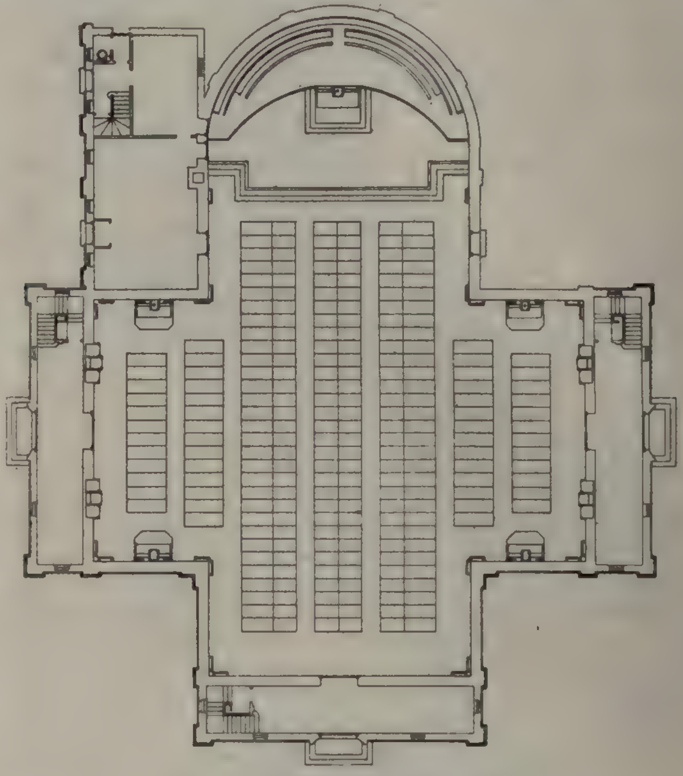
In a recent letter to Mr. W. E. Payne, bureau secretary of the Vancouver Board of Trade, Hon. Dr. King, minister of public works for British Columbia, stated that it was the intention of the government to provide hard surface paving on all trunk roads in the province, leading out of the larger centres, as rapidly as finances would permit. He also pointed out that this year the government was continuing the hardsurfacing of the road through Burnaby, and Fraser Ave., in the municipality of South Vancouver; also a portion of No. 3 Road, Lulu Island.

Church of the Madonna Della Defesa

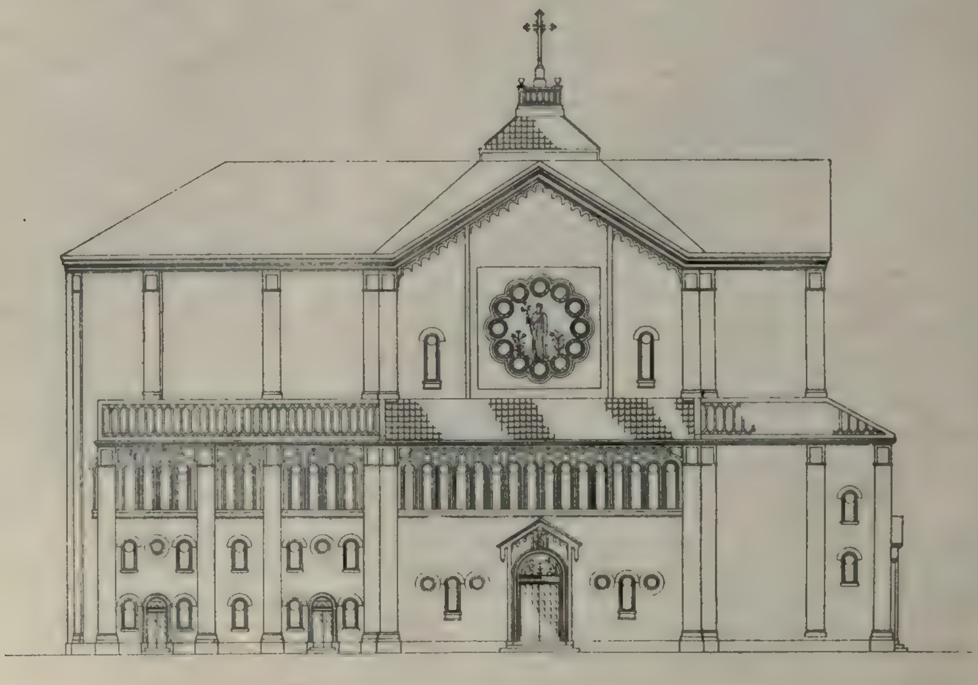
MESSRS. Montbriant and Nincheri, architects, Montreal, have prepared plans for the Church of the Madonna Della Defesa, the general contract for the construction having been let to Mr. John Dominique, Montreal. The building to be 110 x 140 and will be erected on Suzanne, St. Julien and Alma Streets. The church consists of the main auditorium and two wings, providing accommodation for 1000 worshippers. The foundations are to be of concrete, the exterior of St. Lawrence brick with stone base, and the interior of ornamental plaster work. The brick work will be of an ornate character, consisting of a large number of panels, and designs in light and dark brick. The plans provide for similar schemes of ornamentation on the main facade and on two sides. A feature will be very large glass mosaic in centres of the rose windows above the three entrances one on Suzanne St., another on St. Julien St., and the third on Alma Street. Beneath these windows will be a series of smaller windows. The church will be surmounted by an iron cross.

The wings will contain two rows of seats, and as there is an absence of columns there will be an uninterrupted view of the altar. The sanctuary is to be divided from the auditorium by brass rails; behind the sanctuary is the main altar, and in the rear, rows of stalls for the choir and clergy. Four small altars will be located in the wings. On the west side there is to be constructed a sacristy and vestry, with entrance to the sanctuary; above this will be a private chapel, and above this again the organ gallery and choir.

Three small galleries will be constructed over the vestibules, reached by stairways leading from inside the vestibules. The roof is of galvanized iron over a steel frame, and the porches over the entrances will be of asbestos. The interior walls are to be of plaster, while the floors are of terrazo and hardwood. The heating will be by hot water, the furnaces being located in a small cellar under the sacristy. This church is to be erected for the Italian parish of Our Lady of the Defense; Rev. P. G. Vangelisti is the parish priest.


Plan of new Italian church, Montreal.

Wall board of various kinds has long been used, both in permanent and temporary structures. A new use for this material was brought to light when a war savings campaign utilized it as a backing for posters.


Handsome structure being erected for the Italian parish of Our Lady of the Defense, Montreal.

An Example of War Construction Efficiency

THE whole world is gratified at the rapidity with which the United States is taking hold of its share of the world war. Now that the war wheels are at last turning smoothly there are many examples of efficiency methods being shown by our neighbors that may well be studied by Canadians. One of the best of these is described in a recent issue of Engineering News-Record, which tells how, by proper co-ordination of the various operations:

An unusually high speed in placing concrete is being developed in constructing the new $3,000,000 quartermaster's depot at Chicago. With a special crew for each operation and all operations carried on in prescribed sequence, and by nearly automatic plant handling of materials, concrete has been put into forms at the rate of 1200 cu.yd. in five hours and a common day's run is 1650 to 1700 cu.yd. The result has been a gain in speed which promises to save six weeks' time on a job scheduled to require only six months for completion.

Speedy Handling of Large Volumes of Material.

Quick handling and fabrication of large volumes of materials formed the construction problem. The Chicago quartermaster's depot is a six-storey reinforced concrete frame and brick wall building covering, with court included, a ground area of 325 x 600 ft. The floor area is 1,250,000 sq.ft. or approximately 29 acres. Very massive construction is employed. The foundations are 611 concrete piers, 4 and 4½ ft. in diameter, sunk in open caissons to depths of from 23 to 27 ft. With their mushroomed bases the foundation piers contain 11,000 cu.yd. of concrete. Starting with a diameter of 36 in. at pier tops the column tiers decrease in diameter to 18 in. on the sixth storey. Columns are spaced 18 ft. in both directions and carry 8-in. slabs reinforced for a live load of 300 lb. per square foot. Between wall columns the slabs for a width of 3 ft. are deepened to 13½ in., thus forming at each floor a shallow belt girder.

Summarized, concrete work quantities are: 62,000 cu.yd. of concrete; 3,500 tons of reinforcing steel, and 4,000,000 ft. b.m. of form lumber. These figures give 64½ ft. b.m. of lumber and 113 lb. of steel per cubic yard of concrete. In columns alone 5½ miles of spiral and vertical rods were used. The volumes of construction materials which had to be handled and fabricated become impressive when figured in these terms, but still more impressive when the speed factor is considered.

The construction time schedule as laid down at the beginning of the work was: Excavation, 30 days; foundation piers, 30 days; concrete frame, 60 days; brick and terra cotta, 30 days; finishing the building, 45 days; a total of 195 days. The date for completion of the work was set at Oct. 15, 1918. Excavation was begun Mar. 6 and on June 30 the time schedule had been exceeded by 37 days. If the same rate of gain is maintained, the work will be completed by Sept. 1, or six weeks ahead of the date scheduled.

Carefully Planned Schedule of Performance.

Organized coordination has been named as the means for the exceptional construction speed attained. This co-ordination began with a carefully drawn schedule of performance. Then the regular arrival of materials and supplies was planned. The plant was laid out in duplicate to prevent interruption from breakdowns, made as nearly as practicable automatic to reduce attendance, and co-ordinated unit to unit to a set nominal capacity. Plant and manual operations were then meshed closely with one another. Finally, the labor force was broken up into crews to secure the maximum practicable subdivision of duties, and all crew operations were time tabled.

The main plant unit is that for mixing and distributing concrete. It was planned that all operations of this plant should be mechanical, from the first unloading of the material cars to the distribution of the mixed concrete to receiving hoppers on the building floors being concreted.

All materials come in on railway tracks parallel to the front of the building. The building consists of two units separated, except for a narrow connecting structure, by a court 46½ ft. wide. At the entrance to this court, in front, is set a quadruple bucket hoist tower which delivers to four radial chutes. Twin mixers at the foot of the tower are charged by gravity from overhead bins set in a frame structure close in front of the tower. Sand and stone arriving on a track about 250 ft. back of the building are unloaded into a bin paralleling the track and are conveyed thence by a series of belt conveyors to elevator legs at the foot of the bin structure. Four elevators lift the sand and stone to the bins. Cement arriving by car on another parallel track nearer to the building, is taken either from cars or from a store house to the bin elevation by inclined belt conveyors.

Delivery of materials to the mixer bins constitutes the first series of operations. The storage bins for sand and stone are 1,000 ft. long and hold at each end three cars of sand and in the middle compartment eight cars of stone or gravel. They are 6 ft. deep. Cars on parallel tracks on either side are unloaded by locomotive cranes into the bins. In the bottom front of the bin, facing the building, are 52 slide gates which feed onto belt conveyors operating in a pit along the toe of the bin.

The Conveyor System.

There are two conveyors, each 500 ft. with 24-in. belts. The belts travel in opposite directions toward the middle of the bin, casting their loads into a centre hopper which delivers onto two 30-in. belts extending at right angles 301 ft. toward the mixer bins. These 30-in. belts run in a tunnel under the railway tracks and yards. At the end of the tunnel the material is fed onto twin inclined belts which run to the receiving bin located at the bottom of the bin structure. Four 15-hp. electric motors operate the belt conveyor system up to this point.

Four stands of elevators raise the sand and gravel to the elevated bins over the mixers. The receiving bin previously mentioned feeds by gates into troughs which are emptied by chain drags into the elevator boots. Each elevator is driven from the head by a 30-hp. electric motor. The chains carry 8 x 16-in. heavy pattern cups and each set discharges into a hoppered chute leading to the proper storage bin.

Cement delivery is a more simple operation than is the delivery of sand and stone. From the cement store-house, having a capacity of three carloads, two 30-in. belt conveyors reach to the cement-handling floor over the elevator bins. At the bottom these conveyors are so arranged that the cement bags can be unloaded on to them directly from the cars or from the stacks in the cement house. At the top they discharge on to roller chutes ending on the grid top of the cement bin. There the bags are untied and emptied by hand.

Mechanically, the material handling installation is simple. By arranging the long storage bin compartments so as to store sand at each end and coarse aggregate in the middle, and by having duplicate conveyors throughout, if one conveyor breaks down or is stopped for repair the other alone can deliver both sand and stone by taking them alternately.

Mixing and Distributing Operations.

All operations of mixer feeding are by gravity. The cement bin holds three carloads and the sand and stone bins have capacities respectively of 360 and 600 cu.yd. These amounts are sufficient for a half day's run of the mixers should there be a breakdown of the material conveying system. The batch charging hopper is located directly over the mixer and under the bins. Measuring chutes lead from the bins to the hopper, and as soon as one charge is withdrawn from the hopper into a mixer the hopper is filled again for the other mixer. There are two 56-cu. ft. mixers with a rated capacity of 85 cu.yd. per day. They discharge directly into the tower buckets. The mixers are the only steam-operated unit of the concreting plant; two 40-hp. boilers outside of the bin structure furnish the steam.

The distributing tower is 14½ ft. square and 250 ft. high. It accommodates four 2-cu.yd. buckets which are handled by electric hoists. Four distributing chutes terminate in receiving hoppers which are moved from place to place on the floor being concreted so as to keep the cart haul short. The longest run of any spout is 500 ft., and in no case so far has the cart haul exceeded 100 ft.

Plant co-ordination is manifested in the train of mechanism described in these obvious particulars. Machine attendance is reduced to the minimum by employing electric drives. This reduces the chances of any unit being undermanned by workmen laying off and thus cutting down the output of co-ordinate units. Duplicate units are provided of all moving mechanism so that a breakdown of one unit of a pair does not wholly stop the output. Indeed, each unit of a pair, by a little speeding up, can even maintain the normal output for a period of emergency. Finally, of course the capacities of all units, of conveyors, elevators, charging hoppers, mixers, buckets and chutes, have been regulated to the same nominal capacity, which is 1,800 to 2,000 cu.yd. per day.

Getting steel reinforcement and form lumber to the workmen was planned with as careful an eye to co-ordination as were the concreting operations. The first step was field shop fabrication to as great a degree as possible, the next was the planning of special "long-stuff" hoists and the last was gang sub-division, which is considered later.

Field Shops Contribute to Group Handling.

Field shops were established for fabricating reinforcement and form members and for casting concrete blocks to support floor slab bars. At the steel shops column spirals were assembled complete and bars were cut and bent. The sawmills cut all staging and bracing timbers to exact dimensions for erection, and here also column capital molds and floor lagging panels were fabricated complete. The block yards delivered, precast and cured, more than a hundred thousand 4x4x6-in. concrete "chairs" for slab rods.

The shops contributed to group handling and transportation. For example, all the reinforcement of a column was handled as a unit. Column head molds were handled assembled as units. Lagging boards were cleated together in three-board panels, and one piece was handled instead of three. Furthermore, all reinforcing rods, spacers and chairs for a complete panel were got together, hauled, hoisted and placed in a single sequence of operations. This was repeated for another panel and so on. Many similar methods were followed in handling form members. The handling crews, in a word, moved groups of members, each group containing all the members required for a unit of construction. By this means each handling crew gained the efficiency due to concentration of attention and each erecting crew could proceed from panel to panel without delay in sorting and rehandling and waiting for delayed deliveries of certain members. Special long material elevators helped materially in speeding the handling of bars and lumber.

Subdivision of Duties Increased Labor Output.

Manual operations comprised principally handling and placing reinforcement, erecting and dismantling forms and wheeling and placing concrete. Coordination in these operations followed two principal directions; obtaining maximum practicable subdivision of duties by having a separate trained crew for each operation, and scheduling the performance of each crew so that it worked in coordination with other crews, either adjacent or remote.

Actual direction of construction work is in the hands of a general superintendent and a group of engineers, superintendents and foremen. Under these men the working force was so organized that each crew performed only a certain prescribed operation and by repetition became particularly rapid and exact in its work. Two examples will illustrate the system:

On the building the form erection gang comprises the following crews: (1) Sets the uprights and braces them; (2) places the top-timbers and establishes levels; (3) sets the column forms; (4) lays the floor lagging; (5) greases the column forms. The reinforcing gang is divided into the following crews: (1) Carrying and laying slab rods; (2) spacing and wiring slab rods and placing concrete chairs; (3) setting column spirals; (4) bending down column verticals to be tied into the slab reinforcements.

Crew operations follow a regular order so timed that the various processes of erecting forms and placing reinforcement mesh with one another. This scheduling of work, though adhering to a general plan, is in the hands of the crew and general foremen, who shift their men and points of operations as need arises, so that all operations will coordinate in time and sequence. In a measure, the task is intricate. The secret of its successful performance lies in each crew having only certain fixed duties to perform and so becoming remarkably quick and accurate, and in centralizing the direction of the crews. This centralization is so close that quick shifts are possible when any operation begins to get out of step with the general march of the work.

Cultivation of Esprit de Corps Increases Efficiency.

The great accomplishment in co-ordinating labor, after all mechanical helps are named, has been the creation of esprit de corps among the workmen. A number of things have contributed to this accomplishment. First has been, perhaps, the appeal to patriotism. Universal success has been won in promoting the sentiment that every man's activity is a direct help in winning the war. The methods, as always in such matters, are too intangible to be defined precisely. For example, however, when the Third Liberty Loan campaign was on, competition was started between different groups of workers to determine which could raise the greatest sum. The iron workers won and as a reward were presented with a flag which was flown from the building. This aroused the spirit of the carpenters, who asked permission to present a permanent building flag and staff to the Government. The offer was welcomed and on June 1 the dedication of this flag was celebrated with speeches and ceremony. This gang rivalry was encouraged in all possible ways and it did much toward speeding up the work.

Another thing that contributed to the morale of the men was the field hospital service. A well equipped operating and dressing room with a trained nurse in constant attendance and a surgeon at call were provided by the contractors. Every hurt was treated promptly and competently. This had a marked inspiriting effect on the men.. Economically it was a gain both to contractors and workmen, as it reduced time lost due to small injuries and kept the men out of the hands of professional "damage case" sharks. Incidentally, the contractor had in his hands a complete record of every case for his own legal protection.

The Premier Speaks on Housing Scheme

THE Premier of Ontario, Sir Wm. Hearst, in an address to the members of the Ontario Municipal Association at their convention held in Toronto on Aug. 29, stated that the government proposed to co-operate in every way possible with the various municipalities to provide adequate housing accommodation for the industrial workers throughout the province.

He stated that the war and war problems demanded consideration of the housing scheme under discussion from a new view point. Civilization must be maintained and when the men returned from overseas it was right that they should return to improved conditions. He explained that there must be careful cooperation among all classes and all organizations in the country.

Discussing the question of responsibility for the expenditure between the provincial government and the municipalities, the premier thought it rested with the municipality.

One of the most important factors in securing ideals and high standards is improved housing conditions. We must not permit anything approaching the condition of some of the larger old country cities.

We will have no place for slums. The workman must be afforded an opportunity to own his own home. It was of interest to all, employer or employee. Suitable and comfortable housing accommodation will induce workmen to locate in the district. Many of our large industries have difficulty in securing labor through the lack of convenient quarters for their workmen in the district in which their plant is located.

The housing accommodation act which was passed in the provincial house some time since, provided for granting permission to a company or organization to borrow money for the erection of approved sanitary homes for workmen without any profit to themselves. The bonds were to be guaranteed by the municipality and it was required that a member or members of the council be on the board of directors.

A non-partisan committee under Sir John Willison was appointed by the government to make a thorough investigation of the situation. The report of this committee has not been presented yet. The chief difficulty of the housing problem was lack of cheap money, coupled with the high cost of building at present. The premier suggested that an amount up to $2,000,000 be loaned to municipalities at 5 per cent, the municipality taking advantage of the loan to advance, in addition, an amount equivalent to 25 per cent of the government loan. The money will have to be borrowed at a rate considerably over 5 per cent., but the government would contribute this to the scheme. In the premier's opinion, the responsibility was on the shoulders of the Dominion government in view of the fact that the conditions were caused to a great extent by the various munition industries in the province engaged in Federal government contracts. He was advised that the matter is under consideration at Ottawa.

A suggestion made was that the houses to be erected were not to exceed $2,500 in cost, and were to be sold on easy payments. The rent not to exceed $25 per month and the construction to be subject to the approval of the government. The period of the loan was to extend over 20 years or such less time as was considered advisable. The government was securing the best advice from architects in the province.

Naturally legislation will be required, but the government wished to speed up the work as much as possible and everything to that end would be done that could be.

A concrete scheme was received recently from the premier's home city, Sault Ste Marie. In this, it was proposed to make advances to individuals or companies, the individual to own 20 per cent of the total value in land or otherwise. No loan was to be made on any lot less than 30 feet x 100 feet, unless the applicant already owned a smaller lot, but in no instance would an advance be made on a lot less than 25 feet x 100 feet. Loans were to be for periods of five, ten or fifteen years and payments were to be made monthly. All necessary fees were to be fixed and were included in the loan. Separate dwellings only were to be considered except in special cases, and then not more than two-family houses; the maximum cost to be increased to $3,000 due to the increased cost of building. No advance is to be made to erect houses for rental, the idea being to hold the price down to meet the workmen's ability to pay.

It has been found that oil stains on concrete floors may be removed by using a mixture of 1 pound of oxalic acid in 3 gallons of water, with enough wheat flour added to make a paste that can be applied with a brush. Allow the application to remain for two days and then remove it with clean water and a scrubing brush. A second application may be necessary in stubborn cases.

Halifax Real Estate

In Halifax harbour on the Dartmouth side south adjoining the Dartmouth ferry property and running to Marine railway property, Howard W. Wentzell owns 500 ft. of water front property with wharves, buildings, etc. This he claims to be an ideal central property suitable for any large business proposition where water connections with the outside world are necessary. At present this property can be purchased comparatively reasonably. Properties of this class—and few are left—should enhance wonderfully in value within the next five years. Besides this property, Mr. Wentzell has other water front property and is in general a man who keeps thoroughly in touch with real estate. Any parties interested in Halifax property will find Mr. Wentzell a good man to get in touch with.

Leaside Munitions' Company is erecting a number of houses near the factory for the accommodation of their workmen. The C.N.R. management will probably be obliged to follow the same course, and put up dwellings for the yardmen and mechanics at their Leaside terminals.

Activated sludge, when air-dried, is a dark brown, friable, inoffensive material with a slightly earthy odour like that of decayed leaves. It consists largely of humus, but contains much more nitrogen, phosphoric acid and potash than does ordinary farmyard manure.

Estimated Cost of Building Work as Indicated by by Building Permits Issued in 35 Cities

City	July 1918	July 1917	July, 1918, compared with July, 1917 Increase (*) Decrease (†) Amount	Per Cent.
Nova Scotia	**$419,652**	**$99,223**	*** $320,429**	*** 322.93**
Halifax	388,158	56,840	* 331,314	* 582.89
Sydney	31,494	42,383	† 10,889	† 25.69
New Brunswick	**106,473**	**39,500**	*** 66,973**	*** 169.55**
Moncton	19,475	32,400	† 12,925	† 39.89
St. John	86,998	7,100	* 79,898	*1125.32
Quebec	**1,088,070**	**1,583,641**	**† 495,571**	**† 31.29**
Montreal-Maisonneuve	610,045	1,044,295	† 434,250	† 41.58
Quebec	236,875	448,956	† 212,081	† 47.24
Sherbrooke	50,000	66,900	† 16,900	† 25.26
Three Rivers	85,300	19,340	* 65,960	* 341.06
Westmount	105,850	4,150	* 101,700	*2450.60
Ontario	**3,404,716**	**2,440,175**	*** 964,541**	*** 39.52**
Brantford	105,045	7,425	* 97,620	*1314.75
Fort William	104,930	4,600	* 100,330	*2181.09
Guelph	7,565	11,734	† 4,169	† 35.53
Hamilton	168,780	236,415	† 67,635	† 28.61
Kingston	67,182	10,557	* 56,625	* 536.37
Kitchener	54,000	11,290	* 42,710	* 378.30
London	48,685	75,030	† 26,345	† 35.11
Ottawa	1,610,830	59,050	* 1,551,780	*2627.91
Peterborough	9,005	15,450	† 6,445	† 41.71
Port Arthur	9,504	925,470	† 915,966	† 98.97
Stratford	4,189	20,001	† 15,812	† 79.05
St. Catharines	41,658	57,854	† 16,196	† 27.99
St. Thomas	455	5,955	† 5,500	† 92.36
Windsor	78,610	237,340	† 158,730	† 66.88
Toronto	1,094,278	762,004	* 332,274	* 43.61
Manitoba	**240,700**	**182,050**	*** 58,650**	*** 32.22**
Brandon	13,550	18,000	† 4,450	† 24.72
Winnipeg	227,150	164,050	* 63,100	* 38.46
Saskatchewan	**268,385**	**99,485**	*** 168,900**	*** 169.67**
Moose Jaw	71,950	39,025	* 32,925	* 84.37
Regina	53,300	17,360	* 35,940	* 207.03
Saskatoon	143,135	43,100	* 100,035	* 232.10
Alberta	**195,950**	**76,300**	*** 119,650**	*** 156.81**
Calgary	45,000	32,600	* 12,400	* 38.04
Edmonton	150,950	43,700	* 107,250	* 245.42
British Columbia	**139,888**	**70,087**	*** 69.801**	*** 99.59**
New Westminster	5,860	22,850	† 16,990	† 74.35
Vancouver	132,153	27,602	* 104,551	* 382.40
Victoria	1,875	19,635	† 17,760	† 90.45
Total, 35 cities	**$5,863,834**	**$4,590,461**	***$1,273,373**	*** 27.74**

Houston's Annual Review

The Annual Financial Review covering the year ended June, 1918, is just to hand. This is a carefully revised summary of facts regarding securities listed on the Montreal and Toronto stock exchanges and of other prominent Canadian corporations. It includes the current annual statements of companies, the highest and lowest prices of stocks and bonds on both exchanges for each month for ten years, the number of shares sold each month for the past fifteen months, rate of dividends paid for past years and other important items in the history of the different companies, such as increases in capital stock, particulars of franchises, when bonds are redeemable, dividends payable, etc.—information of value to any investor who wishes to make an exhaustive study of any particular stock before placing his order. The review comprises 740 pages of solid information, well printed in a clear and concise manner, and is neatly bound in full cloth. The work is most valuable not only to financial institutions, but even more to the general investing public, whose knowledge of such matters is necessarily limited. Published by Houston's Standard Publications, 84 Bay St., Toronto; price $6.00 per annum, including any supplements that may be issued.

Mainly Constructional

East and West—From Coast to Coast

The reconstruction of the Ashburn bridge in St. John, N.B., is being commenced.

A new building by-law has recently been passed by the town council of Pembroke, Ont.

The council of Aylmer, Ont., will likely build a dam at Stalter Gulley if the consent of the four parties owning the adjoining property can be obtained.

The city of Port Moody, B.C., and the provincial government are proceeding with the preliminary work in connection with the construction of the Ioco Road.

The fish hatchery being erected at Port Arthur, Ont., by the provincial government will have a capacity of 2,500,000. It is expected to be completed this fall.

The city of St. John, N.B., will shortly call tenders for the water service extension to East St. John. It is hoped to have the line in use before the end of the year.

The Toronto Board of Education have decided in favor of erecting a complete unit on the Glengrove school site, instead of erecting a wing, as was previously suggested.

A gang of workmen are at work rebuilding the dam at the Union Mills in the village of Unionville, Ont., and it is expected the repairs will be completed in about three weeks.

The Boards of Trade of South Vancouver, Point Grey and Richmond have determined to make a joint appeal to the Dominion government to proceed with the work of dredging the Fraser River.

A contract for a new duplicate car slip at Vancouver has been awarded to Mr. S. Doe, by the C.P.R. The structure will be built alongside the present one, just west of the immigration shed. It will cost $50,000.

The new temporary station and depot building for the C. G. R. at the South Terminals in Halifax, N. S., is to be ready for occupancy by October. Messrs. Morrison & Downey, the contractors, are pushing the work along rapidly. The building is a temporary one, of wooden construction. The station section, that is the portion to be used by the travelling public, is 180 ft. x 80 ft., one storey. The depot section of the building forms an ell with the station. It is two storeys in height and 240 ft. x 150 ft. in plan.

A new sawmill, which will have a capacity of 15,000 ft. a day, is being built in the municipality of Surrey, B.C., near the junction of the Scott and Peck roads, by Messrs. Lawrence and Rherin, of Port Moody.

The Merlo & Ray Constructing Co., of Walkerville, Ont., has been awarded the contract to build the eastern section of the intercepting sewer that will serve Windsor, Walkerville and Sandwich. Their price was $108,642.

Taylor and McAllister, of Hamilton, Ont., have been awarded the contract for the repair of the Burlington pier. Part of the old concrete work was in danger of falling into the water and it is to be replaced. The work will cost about $10,000.

Negotiations are being carried on between the Ontario Hydro-Electric Power Commission and the Windsor, Essex & Lake Shore Ry., in connection with the purchase of the company's system. The price asked by the railway is $1,000,000.

The town of Oshawa has obtained a judgment against the Ontario Asphalt Brick Paving Co. for $7,400 damages. The defendant company had the contract for construction of pavement in Oshawa, which was alleged to have been unsatisfactory .

The new twenty-room school in Hamilton, Ont., is to be erected at the corner of Ottawa and Main streets, instead of at the Delta location as previously planned. The site selected has a frontage of 244 ft. along Main street and a depth varying from 410 to 620 ft.

The works' department of Hamilton, Ont., is undertaking the work of laying a 20-inch main to supply the residents of the Macklin survey and the McKittrick property. The operations will take about two months' time, over 1,000 ft. of pipe having to be put down.

Work has been started on a new concrete bridge over the Pretty River in Collingwood, Ont., at the intersection of Hume and Raglan streets, replacing a worn-out wooden structure. Mr. H. G. Wynes is carrying out the construction on a cost-plus basis. The expenditure will probably be in the neighborhood of $5,000.

Crane, Limited, have let the contract for a very large factory to Anglins, Ltd., Montreal. The factory is being erected in the south bank of the Lachine Canal, the plans having been drawn by Brown & Vallance, Architects, Montreal. The factory will be used for the manufacture of valves and fittings. The first sod of the foundations was turned by Mr. R. T. Crane, Jr., president of the company.

During the past few weeks the Halifax Relief Commission have arranged for the construction of about fifty more houses in the devastated district. Contracts have been let to the Eastern Investment Co. for 24 dwellings in the Hennessy Field property, and three on Robie street, and to Falconer & McDonald for seven on Agricola Street, while the Reconstruction Department is proceeding with the erection of seventeen dwellings.

The ditches of the drainage districts in Manitoba have been filled up with drifting sand and Chief Engineer H. A. Bowman has received complaints from eight rural municipalities. The damage has, however, partially been averted by the dry summer, and every effort will be made to have all ditches cleared before the spring freshets. The work will cost in the neighborhood of $50,000 and will be handled by the municipalities in the districts affected.

At a recent conference of the town planning commission and the board of control of Hamilton, Ont., a proposition was submitted by the McKittrick Properties, Limited, regarding the erection of houses to relieve the present shortage The company expresses its willingness to finance the building of least a hundred houses, at prices ranging from $1,800 to $2,500, above the 80 per cent. to be advanced by the government. These dwellings would be sold on initial payment of 10 per cent. of the cost, with payment of 10 per cent per annum of the purchase price, together with interest.

Following the recent floods on Nicomen Island, B.C., Mr. Maxwell Smith, chairman of the provincial land board, announced at a meeting of the farmers affected that the dyke along the Slough would be raised two feet, and the public works department would hard-surface this and use it for a road; thus all danger from flooding along the Slough would be avoided. His board, however, did not feel justified in spending any further money on the dykes along the Fraser River until the banks were properly protected from erosion. Premier Oliver stated that his government had on two occasions made grants of $10,000 for building dykes and strengthening them, and could afford nothing further. Mr. Stacey, M.P., said that he would urge the Dominion Government to pay the balance of the cost.

Personals

Mr. S. Fortin, of the Public Works Department, Ottawa, has been appointed deputy director of public works of the city of Montreal, in succession to Mr. A. Martin, who has resigned. Mr. Fortin will have charge of the roads, sewers, and surveying departments.

Mr. A. R. Dufresne, assistant chief engineer of the Department of Public Works, has resigned to accept the position of manager of the St. John Dry Dock and Shipbuilding Company of St. John, N.B. This company is under contract with the government to construct a dry dock of the largest class, also a breakwater, and to dredge an extensive channel and basin in St. John harbor.

Obituary

Mr. Morley Donaldson, M.E.I.C., late vice-president and general manager of the Grand Trunk Pacific, died last week in Ottawa. He was a Scotchman by birth and in his early business life was connected with engineering work in the United States. Mr. Donaldson later was appointed chief draughtsman of the Canada Atlantic Railway, and subsequently general superintendent. In 1905 he became superintendent of the Ottawa branch of the Grand Trunk, and seven years later vice-president and general manager of the Grand Trunk Pacific.

Lieut. Robt. E. A. MacBeth, who before enlistment was assistant to the city engineer of Toronto, has been killed in an aviation accident at a training camp near Birmingham, England, according to word received by his parents at 60 Brock Ave., Toronto. Lieut. MacBeth was a graduate of the Faculty of Applied Science and Engineering, 1911 class. In December, 1915, he completed his aviation course and was sent to England, where he was placed on patrol service along the coast until he was injured in an accident in June, 1916. Upon his recovery from this accident he was sent to the Bahamas to report upon the prospects of the establishment of a school of aviation there. When he returned to England he was given special duty and took many aeroplanes across the channel to France. He was latterly employed in passing upon flying machines before their acceptance by the Imperial Government. It is thought that he met his death while instructing graduate students of the Air Force in this work

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Burgessville, Ont.
Tenders are being received by the clerk, C. E. Burgess, Burgessville, until September 9th, for the construction of a tile drain for the Township Council. Plans and specifications with the clerk and F. J. Ure, Woodstock.

Montreal, Que.
Tenders are to be called soon by the engineer, Paul E. Mercier; for the construction of a sewer for the City Council. Secretary, L. Senecal.

Verdun, Que.
The Town Council will call tenders shortly for construction of an addition to waterworks. Engineer, A. S. Clarkson.

Vermilion, Alta.
Tenders are to be called this Fall for 1720 ft. of 8 ft. sidewalk for the Town Council. Secretary, H. P. Long.

CONTRACTS AWARDED

Baie D'Uree, Que.
Pavement costing $31,500 for the Town Council: General contractor, Charlebois & Schetagne, 238 Bord Du Lac St., Pointe Claire.

Brantford, Ont.
Walks, sewers, etc., costing $75,000 for Lansdowne Park Co.: General contractor for grading, D. O. Johnston. Manager, W. P. Kellett, care of Dominion Steel Products.

Rondeau, Ont.
Pile driving for drainage system costing $8,000 for the Township of Harwich: General contractor, McAllister & Taylor, Sun Life Bldg., Hamilton.

Verdun, Que.
Extension to outfall pipe for the Town Council: General contractor, M. J. Stack Paving & Contracting Co., Ltd., 167 McCord St., Montreal.

Railroads, Bridges and Wharves

London, Ont.
Work is to start in October for $4,000, one storey, metal and lath express shed for the G. T. Rly. Address, Chas. Forrester.

Naramata, B.C.
Tenders are being received by the engineer, F. W. Aylmer, until September 21st, for the construction of a wharf for the Department of Public Works, Ottawa, Ont. Plans and specifications with District Engr., Chase, B.C., New Westminster, and Postmaster, Naramata.

St. John's, Que.
Tenders are being received by J. W. Pugsley, secretary of Department of Railways and Canals, Ottawa, for renewing portion of wharf. Plans and specifications with Chief Engineer, Dept., Ottawa.

St. Thomas, Ont.
Work is to start this fall on a temporary steel and timber bridge costing $8,000 for the County Council. Civil engineer, J. A. Bell & Son, Court House, St. Thomas.

Toronto, Ont.
Tenders are being received until September 10th, for construction of one mile of line for the C. N. Rly. System. Chief Engineer, A. F. Stewart, 27 Wellington E.

CONTRACTS AWARDED.

Bayfield, Ont.
Renewal of south pier for the Department of Public Works, Ottawa: General contractor, Weston Bros.

Collingwood, Ont.
Work is to start at once on a reinforced concrete bridge costing $4,700 for the Town Council: General contractor, H. G. Wynes.

Hamilton, Ont.
The following contracts have been been awarded in connection with the erection of a $3,000, one-storey addition to station for Toronto, Hamilton & Buffalo Ry. Co.; Electrical work, J. Dynes, 20 Avalon Place; plumbing and heating, Adam Clark, 7 Main St. W.; plastering, Hannaford Bros., 232 Robinson St.; painting, Peter Thomson, 13 Walnut St. N.; masonry, Geo. Mill, 614 King St. E.

Sackville, N. B.
Six stations and two tool sheds to be built on eastern end of Can. Govt. Rly. Hicks, Charlotte St.

Shawinigan Falls, Que.
Two storey, frame extension to station costing $4,000 for C. P. Rly. Co.: General contractor, N. Manseau. . . . . .

St. Janvier, Que.
Steel bridge and concrete abutments costing $10,000 for the Municipal Council: General contractors, Gaudette & Lachapelle, St. Ours.

Stuartburn, Man.
Bridge costing $6,500 for the Municipality of Stuartburn: General contractor, J. Kelly, Agnes Ave., Winnipeg.

Public Buildings, Churches and Schools

Bridgewater, N.B.
Site is secured and plans are in progress for a $50,000 hospital for the town and municipality. Architect, Leslie R. Fairn, Aylesford, N.S.

Chatham, Ont.
Plans are nearly drawn and tenders will be called soon for a school for the School Board. Architect, J. A. Methven, 5th St., Victoria Blk.

Dorval, Que.
Tenders are being received by R. C. Desrochers, secretary of Department of Public Works, Ottawa, until noon, September 10th, for the construction of thirty-four buildings as a temporary barracks. Specifications and forms of tender with MacLean Daily Reports Ltd., 345 Adelaide St. W., Toronto.

Drumheller, Alta.
By-law is being submitted for additional rooms to town school and a new school at Medland Mine, costing $20,000 for the Public School Board. Chairman, A. E. Sibbald.

Estevan, Sask.
Wood End S. D. Trustees contemplate the erection of a $3,500 brick school. Secretary, T. Henderson.

Halifax, N.S.
Plans are in progress for a glebe house for St. Joseph's Church, Rusell St. Architect, Ross & McDonald, Sackville St.

London, Ont.
Plans are in progress and tenders will be called about September 10th, for steam heating system for county court house for the County Council. County Engineer, Chas. Talbot, County Bldgs.

Montreal, Que.
Plans are nearly completed and Architect, Brown & Vallance, 128 Bleaury St. will call tenders in about two weeks for the erection of an addition to the central Y.W.C.A. costing $150,000.

Plans are in progress and tenders are expected to be called in Fall by the architect, J. E. A. Benoit, 1198 Wellington St., Verdun, for the construction of a $350,000, one storey, solid and rustic brick Roman Catholic College.

Sandwich East, Ont.
Plans are in progress and tenders are to be called shortly by the architect, A. H. McPhail, Board of Trade Bldg., Windsor, for the erection of a $15,000, one-storey, brick school for the School Board.

Toronto, Ont.
Tenders are being received until noon, September 7th, by H. F. McNaughten, secretary of Department of Public Works, Toronto, for steam heating for a building at 44 Richmond St. W. Plans and specifications at the department.

Tenders are being received until September 9th, for lathing and plastering Orthopedic Hospital for the Department of Public Works, Ottawa. Plans at hospital and Postal Station "F," Charles and Yonge Sts.

Unionville, Ont.
By-law will be submitted to the ratepayers September 16th, for securing electric light and power. Estimated cost of plant, etc., including thirty street lights, $10,000.

Verdun, Que.
The Protestant School Trustees contemplate the construction of a two-storey school to accommodate 500 scholars. Will later be enlarged to five storeys. Chairman, William Rogers.

The Protestant School trustees con-

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The Possibilities in a Canadian Association of Building Contractors

ON another page of this issue we print a full report of a meeting recently held in Toronto to discuss plans for a general conference of building men at Ottawa this fall, the chief object being the formation of a Dominion-wide contractors' Association. Canadian contractors at the present time are very poorly organized—indeed there is probably no trade, profession or industry more handicapped in this respect. There are our Builders' Exchanges it is true, and there are one or two provincial associations, but they cannot, in general, be called representative; a great many of the more important firms are not included in their membership, and at best they are more or less local in scope. The best fruits of organization can only be reaped when there is complete centralization of control and full co-operation in the trade throughout the country. How is this condition to be brought about? First, the ball must be set rolling, and second, the trade in general throughout the country must be shown that it is to their interest to get into the organization—there must be educative work, red-hot propaganda and enthusiastic organizers.

The advantages of organization are entirely obvious if all, or even the majority, of Canadian contractors would get together. The weakness of any trade association is the outsiders. When there is thorough co-operation, wonders can be effected in the solution of legal, political and commercial difficulties. These are numerous and pressing at the present time—there is the question of high prices of labor and materials, transportation, foreign competition, unfair home competition, competition by owners, abuses of the contract, and a host of other problems which can only be solved by united action.

Then there are great possibilities of raising the standard of construction work in Canada, if contractors would get together and consider the technical problems which they meet in their work, making use of their combined experience through the presentation and discussion of papers. Canadian contractors have, up to the present, neglected this means of mutual assistance, which has been used with such beneficial results by manufacturers, engineers, doctors, and other bodies of professional and business men.

If we may judge by the enthusiasm of the Toronto meeting there is every reason to believe that the present movement will yield results. Mr. Anglin is putting his accustomed energy into it and we hope he will be backed up by the rest of the profession.

The Function of the Architect in Building

AS we have frequently stated, it is a peculiar circumstance that there are so very many cases where disputes arise between the owner of a building being erected and his architect. These disputes are generally so serious that it is frequently stated that only in rare cases is the same architect employed a second time by the same building owner. There is surely something wrong here—either with the architect or the owner. What is it?

It has been suggested that the owner expects too much from his architect—and certainly he sometimes seems to expect more than he gets. On the other side it is held that the architect assumes responsibilities and then fails to take care of them, either through inability, carelessness, or fear of antagonizing the contractor. In either case the trouble appears to be in a lack of definition of the architect's duties. No two architects give the same amount of service; no two owners agree as to the amount of service to expect. Could not the duties of the architect be clearly defined? If he is merely a designer let it be so understood. If he is also a supervisor of construction, define his duties clearly. The words "inspection" and "supervision" are open to legion individual interpretations.

The architect, as we see it, is primarily the professional adviser of his client, as well as the designer of his building, and even when the contract has been signed, the architect may still remain the official interpreter of its conditions and judge of its fulfilment. Under present conditions the architect almost invariably assumes the responsibility of inspection, and this is the rock on which nearly all friendly relations between architect and owner founder. As a matter of fact, except on the very small jobs, the owner finds it to his interest to employ his own inspector. This, of course, is an injustice to the owner, who is thus paying twice for the same services.

Looked at broadly, the erection of a building seems to divide itself into three separate operations. There is, first, the design of the building, internally and externally—this is plainly the work of the architect; there is next the determination of the materials to be used, their size and strength, type of construction and so on—this is the work of the engineer, requiring knowledge rarely found in the architect and, so, quite outside his field; then, third, there is the erection of the buidling according to the engineer's figures—the work of the contractor.

Whether the work of the contractor, or contractors, in erecting the building should be supervised, is a matter, surely, resting entirely with the owner. Most owners will prefer to employ an independent supervisor. In other cases they may have such confidence in their contractors that they will not consider this necessary. The main point, however, is that it should be clearly understood that this responsibility rests with the owner. The architect has no right to assume it, because it is a responsibility he cannot fulfill, and the engineer has no right to assume it, unless he is in a position to give his whole time to the work.

It would appear that if the status of the various parties entering into the erection of the building were thus clearly defined, and understood by the owner, there would be much less dissatisfaction and much better erected buildings.

Placing the Crippled Soldiers

REHABILITATION for self-support is the best compensation we can make to our returned, disabled soldiers and the only one that will have any lasting benefit. We have to plan to provide for the thousands of cripples the best possible chance for the future it is in our power to give them. A man who has lost an arm or a leg is only debarred by his disability from undertaking certain operations. In many ways the disabled man will be just as competent and as well able to undertake certain operations as a non-handicapped man. If placed in a sunitable position the disabled man will be just as able an employee and at the same time will be self-respecting and happy and have a keen interest in his future advancement. It is the employer's duty to find a constructive job for the disabled man that he can hold on the basis of competency alone. In the many modern industrial processes it should be a very easy matter to find work not requiring the operations from which any given type of cripple is debarred. In such jobs as the cripple can fill, he certainly should be given the preference and also be given an opportunity to develop to the utmost of his ability in the work undertaken.

The many instances of cripples holding very important positions in the industrial world are well known, but in the majority of cases these men have succeeded in spite of the employers, rather than because of their assistance. A suitable job is wanted for the disabled, not alms. Help the cripple to become independent, not a dependent on charity. Our point of view has been changed with our new responsibility to the men who have become disabled fighting for us. Give the man a chance—he will make good. The government is doing everything in its power in its vocational training department, but unless it has the cooperation, interest and support of our industrial leaders it cannot realize the unqualified success it deserves.

Standardized Construction for City Pavements

THE general use of the motor truck and the exceedingly heavy loads carried are responsible, to a great extent, for the rapid deterioration of our paved city streets. These highways were not designed in every case, to sustain the various stresses created by heavily laden moving vehicles. The upkeep of our pavements is placing a heavy strain on the taxpayers and the city is criticized for having failed to provide structures equal to the task.

The size of trucks and the loads permitted to be carried are not limited or restricted by by-law, in general, and until engineers know at what speed loaded trucks will be permitted to travel, what loads can be carried and what width of tires are allowed for any given capacity, they cannot design an economical pavement. All of the vital highway problems have not been solved. Proper drainage, foundations, frost action, wearing surfaces, length of service, maintenance and cost, are engaging the attention of the engineers, but actual facts and reliable data seem hard to secure. Information of this kind takes many years to obtain, but it is being accumulated. With this information and with fixed load and speed factors, it will be possible to develop design on a scientific basis.

Traffic of the heavier kind should be rigorously restricted to streets where the pavements will unquestionably sustain it, and until this is done our road maintenance bills are certain to be very high. The truck owner is the barometer of the manufacturer, indicating the size, capacity, etc., of the truck best adapted to his requirements. Would it not be possible for the truck manufacturers, transportation companies and highway engineers to arrive at some definite understanding and endeavor to formulate plans that will benefit all concerned, including the overlooked taxpayers?

Putting Panels in Posts

In making concrete gate posts to be used on a large country estate, the following method served to place an attractive panel in the road side of the posts. We made a form with pyramid top, laid on the molding floor. The usual corner strips were nailed in, with the sides of two of them flush with the edges of the form side members. A rectangular frame of ¼ in, strips, outlining a panel, was then positioned on the bottom form board and tacked in place. A thin wash of fire clay—though any clay will serve as well—was then run into this panel to a thickness of about ⅛ in. or so, when wet. Broken stone, as used for the aggregate, varying in size from ¾ in. to 1½ in., were then placed in the clay, with a flat surface next to the form. When the clay had hardened somewhat the rectangular form of strips was removed, a bucket of mortar served with care covered the stones and the rest of the form was then filled in the usual way. Reinforcing to the extent of four corner bars did not interfere with the placing of the panel. On removing the form, brushing out the clay and washing each post with a neat mortar coat, a rather good looking ornamental post was achieved at little additional cost over the ordinary unpaneled ones. The faces of the stones in the panels were placed irregularly, but the idea might well be carried out in mosaic or initial patterns, and with regular or uniform faced pieces. However, for the purpose desired, this irregular aggregate gave an attractive effect.—Concrete.

Steel Mixture Iron—The Use of Scrap Steel in Pig Iron Mixtures

THE use of semi-steel castings is becoming quite general for certain classes of work and, as it is a more or less modern development, its composition is not generally known outside of the trade. A very interesting article by J. E. Hurst, on the addition of steel to cast iron, appeared in a recent number of the "Engineer". The term semi-steel which is now applied to all those cast iron mixtures of which steel scrap in some form or other constitutes a part, is frequently widely misinterpreted. Strictly speaking, the true semi-steels are those iron-carbon alloys whose carbon contents are approximately midway between those of steel and those of cast iron. The addition of steel scrap to cupola mixtures does not bring about sufficient modification in the carbon contents; and a modification of the quantity of the other constituents, silicon, etc., does not justify the application of the term semi-steel. Indeed, malleable castings produced by the annealing of white irons according to the old English process are strictly the true semi-steels, and the alternative title of "steel mixture iron" is suggested for those cupola melted cast irons of which steel scrap constitutes a portion of the burden.

The use of steel scrap in pig iron mixtures melted in the cupola has now become extremely common in both cast and malleable cast iron foundry practice. Mixtures containing as much as 50 per cent. of steel scrap along with pig or scrap cast iron are now frequently melted in the cupola for the production of high grade grey cast iron castings. Such additions form a very satisfactory means of reducing the slicon content, and by the same means a very substantial reduction in the phosphorus content can be brought about which is a consideration of the utmost importance, in view of the difficulties in obtaining hematite and other low phosphorus irons. The addition of scrap steel as a portion of blast-furnace burdens has been made with this same object in view.

The mechanism of the reduction of the melting point of steel in the cupola by the absorption of carbon from the coke and carbonaceous gases is now generally familiar. Broadly speaking, the amount of carbon absorbed by steel melted under cupola conditions is about 3 per cent., but there is every possibility of the amount varying between fairly wide limits about this percentage, the variations depending upon the conditions during melting. The factors involved in the absorption of carbon by steel during cupola melting are:

(1) The temperature attained in the cupola.
(2) The time of contact of the steel with the carbonaceous fuel and gases.
(3) The surface area per unit mass of steel, exposed to the direct action of the carburising influences.

When these factors are fully considered, the possibility of fairly wide variations in the carbon content of the final product, and also the necessity for standardizing the conditions of melting, as far as possible in individual circumstances, will be readily apparent.

The following experiment illustrates the absorption of the carbon by steel during melting in the cupola. A charge consisting of hematite and scrap cast iron, together with 20 per cent. steel scrap, in the form of borings and plate punchings, was charged into the furnace in the following order: (1) Steel; (2) hematite pig; (3) scrap iron. Almost immediately after the blast was turned on, a sample of the molten drops of metal was collected at the tuyere zone by means of a small clay crucible, attached to a suitably bent steel rod, introduced through one of the tuyeres. The analyses of the samples collected in this manner and of the final metal, are given in the table.

	Sample 1.* Per cent.	Sample 2.* Per cent.	Final metal Per cent.
CC	2.50	2.94	0.86
Gr	—	—	3.07
Tot C	2.50	2.94	3.93
Si	1.21	1.59	1.63
Mn	—	—	0.48
S	—	—	0.085
P	0.73	0.74	0.66

* Samples 1 and 2 quenched. Carbon wholly combined.

The rapid increase in the carbon content of the metal, and the fact that a large proportion of this absorption takes place after the metal has passed the tuyere zone and whilst lying amongst the bed coke in the hearth of the furnace, is shown by the analysis of the final metal tapped out into the ladle. This is an important consideration in the production of low total carbon content irons. The increase in the silicon and the curious behaviour of the phosphorus in these samples are worthy of note, and amply illustrate the rapidity with which the whole of the charge melts.

The melting of steel scrap alone in the cupola with the resulting production of a high carbon content metal, comparatively free from other elements, has apparently long been known, and frequently been used in the Bessemer steel practice. It is stated that the late Mr. L. F. Gjers, of the Gjers Mills Company, Middlesbrough, was probably the first to introduce this process[2]. Dr. Stead, in the correspondence on the report of the Malleable Cast Iron Committee of the Iron and Steel Institute, mentions the fact of having himself utilized this process years ago for the production of fluid iron for the purpose of re-carburising Bessemer blown metal. Dr. Stead's product was a white iron of the following approximate composition: CC, 3.00 per cent.; Si, nil; S, 0.15 per cent.; Mn, 0.4 per cent.

The present author himself has independently carried out similar experiments with exactly similar results[3]. The product obtained by the direct melting of steel in this manner, as would be expected from its extremely low silicon contents and the conditions under which it is produced, is extremely "wild," and for the production of sound pigs must be suitably killed by silicon, manganese or aluminium additions. Dr. Stead states that the pigs produced by this method are decidedly "honeycombed." On this account, the direct melting of steel scrap with a calculated quantity of high silicon pig iron, as suggested by Dr. Stead for the production of pig iron for malleable purposes, is probably the better course to pursue. The practice is pursued by certain of the producers of so-called "refined pigs" for malleableising. Obviously the proportion of steel scrap per charge will depend entirely on the silicon content of the remaining portion, but there does not appear to be any doubt that the presence of 0.5 per cent. silicon absolutely ensures the production of perfectly quiet metal and sound pigs.

The comparative ease with which steel borings in all but very finely divided forms can be melted in the cupola does not appear to be generally recognized. By using smaller charges both of metal and fuel, thus bringing about a more intimate mixture of fuel and material, and, incidentally, a more extended melting zone, steel in this form is very readily melted. This consideration is probably of great importance in ensuring a more extended and greater degree of preliminary carburisation of the high layers of the charge. Extremely finely divided steel borings have a tendency to throttle the blast and promote scaffolding. Probably the greatest drawback to the use of steel borings is the difficulty of handling for charging purposes. This difficulty—on a large scale—could be easily surmounted by the use of open top cupolas and electromagnetic lifting appliances.

The absorption of sulphur during the process is frequently very large. It can to some extent be checked in the cupola by the addition of sand along with the limestone flux. It is suggested that the use of low grade manganese ores, which ought to be cheaply obtainable, would be of considerable advantage in the elimination of sulphur. With ordinary care, however, and the use of high grade coke, the extent of the sulphur absorption is of little moment in this process, if the metal is intended for the English malleable process.

The following results were obtained on melting steel borings and crop ends from the smithy in a cupola together with 10 per cent. ferro-silicon. The final metal contained approximately .6 per cent. of silicon and 3 per cent. total carbon. The whole of this latter constituent is absorbed from the fuel in the cupola. Test bars were cast and annealed along with similar bars of hematite malleable pigs. The results obtained are given below:—

Mixture number.	(1)	(2)	(3)	Steel mix.
Maximum stress	9.2 tons	13.75 tons	18.0 tons	9.8 tons*
Maximum stress	22.0 ton	27 tons	25 tons	30 tons†
Elongation ..	3 per cent.	3 per cent.	3 per cent.	3 per cent.†
Bending angle	35 deg	35 deg.	35 deg.	42 deg.†

(1) Special hematite malleable pig.

(2) Special refined pig—probably made by melting steel scarp.

(3) Mixing containing malleable scrap.

* As cast condition

† Annealed condition.

In the present shortage of hematite malleable pig, the more extended official use of steel scrap, particularly steel and borings and turnings, for the purpose of making malleable pigs would be of distinct national advantage. The use of scrap high silicon cast irons as used for the production of non-corrosive chemical ware is suggested as a possible cheap source of high silicon material necessary for the production of sound pigs.

The Cost Plus Method of Contracting

THE Convention of Building Industries which met recently at Atlantic City attempted to pass a resolution in favor of "Voiding so far as practicable so-called cost plus contracts," inasmuch as various departments of the Government looked with disfavor upon cost plus contracts. Mr. P. B. Glassco, President, George W. Stiles Construction Co., discussing this question in Engineering and Contracting says: It seems strange that a body of men who should be well informed in regard to building matters under present conditions would attempt to pass such a resolution, and the fact that after discussion it was not passed, goes to show that there are a great many things to be said in favor of cost plus work.

The greatest advantage of the cost plus system is that on urgent work it permits work to be started without waiting for the plans to be completed, thus making a great saving in time, and also probably in cost, as an efficient contractor, working with an architect or engineer, can no doubt make suggestions that will save money as well as time.

If the work is not so urgent and will permit the finishing of the plans and taking bids, the proper kind of cost plus contract should save an owner money under present conditions, for in bidding on lump sum contracts, reliable and experienced contractors will undoubtedly add a larger percentage of profit than they would under ordinary conditions, and in addition put on considerable for contingencies in the way of advances in wages, prices of materials, freight rates, and other risks. If these contingencies do not arise, the owner still has to pay for them and the contractor makes a larger profit than he is really entitled to. In actual practice it has often worked out that all bids are considered to be excessive and the project is either abandoned or shelved for the time being, or else new bids are taken in the hopes of finding a contractor who is willing to take large risks for a slight prospective profit.

Incentive to Make Good.

There have been abuses in connection with cost plus work, possibly more on public work than on private, but instead of condemning the cost plus system outright, it seems to us that it would be better to attempt to develop a cost plus system which would eliminate abuses as far as possible, and we believe that the best way of eliminating abuses is to give the contractor every possible incentive to make good. This can be accomplished by a system which puts the contractor on his mettle to achieve and maintain a reputation as an economical and efficient builder, and which also makes his pecuniary reward dependent upon his degree of success in carrying out his contract.

Where speed is essential and where it is desirable to start the work before plans are finished, the architect or engineer will naturally pick from the contractors known to him the one best suited for the particular job, and abuses can only be avoided by securing a contractor of unquestioned honesty and ability. Where there is time, however, to prepare complete plans and specifications, some of the good points of lump sum competitive bidding can be combined with a cost plus system, which embodies the incentives of "making good" referred to before, and the owner can secure the benefit of both systems. An outline of such a combination which we have suggested to several architects and engineers recently and which has been used by them in taking bids, is as follows:

A Combination Tender.

The architects or engineers invite four or five honest and competent contractors to submit competitive bids on the amount of the lump sum fee for which they will do the work on a cost plus basis. Each contractor submits with his bid on the fee a detailed estimate of the actual cost of the work and is required to guarantee his estimate to the amount of one-half of his fee; that is if the actual cost should exceed the estimated cost, the overrun is to be deducted from the contractor's fee up to one-half the amount of the fee. This gives the contractor every incentive to keep the cost as low as possible in order that he shall earn his full fee, but is not so strong as to cause him to risk his reputation by slighting the work, as he is certain of at least one-half his fee. An added incentive for economy and efficiency is to give the contractor a percentage (usually 50 per cent) of any savings in cost under the estimated cost.

Several tryouts of this system, where the contractors were given their option of submitting either lump sum bids or cost plus bids, showed that the contractors were strongly in favor of the cost plus system, and in one case, at least, no bids were received on the lump sum basis, all the contractors electing to submit bids on the cost plus basis. In instances where lump sum bids were submitted the cost plus bids were found to be considerably lower.

An outline for invitation for either lump sum or cost plus bids which, of course, will have to be amplified or varied to suit any particular job, is as follows:

Outline for Invitation.

The owner will consider bids submitted on the usual lump sum basis also bids on a "cost plus" basis. Contractors may bid under either or both methods as outlined below:

1. Lump sum bid to be made for all branches of the work as listed below, except that the mechanical branches may be omitted if desired. Bid shall state specifically all branches included:

Wrecking ....
Excavating ....
Masonry ....
Etc. ....
....
....

2. Cost plus bid shall state a lump sum fee for which the contractor will do the work on a cost basis, cost to consist of all expense in connection with the work except overhead expense of contractor's main office. The contractor shall also submit with bid his estimated cost of the work except the mechanical branches, but the superintendence and handling of these branches shall be covered by his lump sum fee. Any overrun of the cost above contractor's estimate shall be borne by the contractor up to one-half the amount of his fee, any balance by the owner. Any saving shall be divided equally.

Estimated cost shall be given in detail by branches as outlined below. For various items included under each branch refer to the general specifications.

Overhead expense shall include liability insurance, fire insurance, permits, temporary offices, sheds, fences, toilets, etc.; phone, heat, light, etc.; traveling expenses, superintendent, foremen, timekeeper, water boy, watchman, etc.; plant costs, freight, rentals, repairs, depreciation, tools, etc.; and other items of overhead expense.

The architect will require the contractors whose propositions are favorably considered to submit complete detailed estimates showing quantities, unit with original quotations, wage scales etc., used in estimating, all to be checked and approved by the architect before contract is awarded.

1. Overhead expense ....$..........
2. Wrecking ....$..........
3. Excavating ....$..........
4. Etc. ....$..........
5 ....$..........
Estimated net cost ....$..........
Lump sum fee ....$..........

Total ....$..........

Any architect or engineer can, no doubt, work out his own form of contract for this system of cost plus work, making it as simple or elaborate as he pleases.

Most Pleasant Relations.

Last but not least, on the cost plus work which we have done, we have found that our relations with the owner and architect have been most pleasant and agreeable as all our interests are identical, that is, to do good work as economically as possible; and as we are sure of a certain, if small, compensation for our skill and ability as builders, we find that much of the friction is eliminated which is bound to arise under a lump sum contract, where it is to the contractor's interest to do as little as possible under the plans and specifications, whereas it is to the owner's and architects' to demand as much as possible.

A Handy Arrangement for Concrete Mixer

(Contributed)

One of our competitors came into our plant just a short time ago and noted an arrangement which we have used from the time we first bought a Blystone mixer and which we thought little of until he called our attention to its helpfulness in handling cement, as we are compelled to handle it in our small plant. We have a one-bag mixer. First we shovel in one-half of the amount of sand for a batch, then add a bag of cement, the mixer working the meantime by power; then add the rest of the sand, thus securing what we find to be a proper mixture.

The "kink" is this: We had a tinner add a piece of galvanized iron about 12 in. wide full length on one side of the mixer, on which can be laid a bag of cement, while the workman unties the end of the sack. The cement thus falls right into the mixer, the shelf giving it support while the wire end or tie to the bag is being handled. Without this shelf, as we call it, the workman must first loosen the wire from the sack, while on the floor next to mixer, and he has no rest without the shelf while he runs the sack back and forth to empty contents.

Organization Meeting for General Conference of Building Contractors

A meeting was held in Toronto on Wednesday, Sept. 4, at the headquarters of the local Builders' Exchange to discuss plans for the contractors conference proposed to be held at Ottawa this fall. The object of this conference is to form a Dominion-wide association of building men, for the purpose of furthering the interests of the trade and improving building conditions generally Mr. J. P. Anglin, president of the Montreal Builders' Exchange who is the moving spirit behind the project, has outlined a draft programme as follows:

Contractors' Conference.

Proposed Ottawa Programme.

1. Provincial Roll Call (number from each)
2. City Roll Call (number from each)
3. Section Roll Call
   1 General
   11 Sub or Trade
   111 Supply
4. Organization for Conference
   (a) Order of Programme Committee to arrange and post details of programme.
   (b) Builders' Exchange (future usefulness of)
   (c) Publicity Committee (Press, notices etc.)
   (d) Three Entertainment Committees (one each day)
   (e) Tendering
      Quantity Surveying
      Method of calling and opening Bids
      Contract & Bid Bond vs. cheques.
      Contracts—Standard Agreements, unit prices, etc. Cost - plus - fixed - Sum Contract.
   (f) Labour
      Labour Trade Parliaments
      Employers' Apprenticeship & Technical education.
   (g) Materials Committee
      Resources, economy, readjustment, standardization.
   (h) Future Business
      Industrial housing, concrete roads, etc. contract farming.
   (i) Business Relations
      Public Works, Architects, Engineers and Owners, Sub Contractors & Supply Houses.
      Powers of Superintendent or Inspector and Arbitration.
      Foreign competition and Plan making.
   (j) Building By-laws and Lien Laws Committees.
   (k) Other organizations. Our relation to Board of Trade & Mfg. Association, etc.
   (l) Code of ethics as between General Contractor. (1) Receiving bids & Awarding Work. (2) Payments. (3) Bonds. (4) Bonus and penalties.
   (m) Zones of operation, plant, yards etc.
   (n) Trade papers & Daily reports. Building Statistics.

Montreal, London, Galt and Toronto were represented at the preliminary meeting in Toronto. The Montreal men were Messrs. J. P. Anglin, John Quinlan, D. K. Trotter, C. F. Smallpiece and J. D. Johnson; while from London, there were present, Harry Hayman, president of the London Exchange, T. R. Wright, secretary of the Exchange, Geo. R. Hyatt, A. G. Robb, and Edward and Geo. Hayman of John Hayman & Sons. The Toronto men present were Messrs. H. Elgie, Geo. Gander, W. Davidson, H. Dancy, W. E. Dillon, president of the Toronto Exchange, G. E. Stocker, of Jas. A. Wickett, Ltd., and R. Jackson, of the Jackson-Lewis Co.

The meeting was opened by Mr. Davidson, who welcomed the visitors and invited them to make themselves at home in the Toronto Builders' Exchange. Mr. Anglin commenced the discussion, pointing out the value of organization and stating that the Minister of Public Works was willing to meet a delegation of contractors and consider the various problems relating to government work, and legislation. He referred to the conference which had been held by the building men of the United States at Atlanta, Ga., on July 15-16, when a National Federation of Building Industries was formed, an organization similar to that which it was now their object to bring about in Canada, and suggested that this established a good guide for them to follow.

In order to proceed with the discussion of the plans, Mr. Dillon was elected chairman of the meeting and Mr. Wright, secretary. Mr. Anglin presented a resolution that "We contractors and supply men gathered here, after a full discussion of the building industries of Canada, express ourselves in favor of forming a new contractors' association, to be called 'The Canadian Association of Building Industries.'" This resolution was unanimously carried. Mr. Jackson brought up the question as to whether it was advisable to include supply men in the new association. He considered that it would be on a firmer footing if, for the time being at least, the membership should consist of contractors only, as the supply men had associations of their own and would only give partial interest and support to the proposed organization. Mr. Elgie moved and Mr. Anglin seconded that the meeting form into three commitees to discuss the matter—general contractors, subcontractors, and supply men. The motion was carried and it was decided that after the three sections had considered the question from their own viewpoints, they meet again in the afternoon at 2 p.m and submit the results of their deliberations.

In the general contractors' committee, Mr. Jackson held to his point that it would be in the best interests of the new organization that it include only contractors. The majority, however, did not coincide with this view. Mr. Quinlan said that the main object of the proposed association was to obtain legislation from the government and for this purpose it would have to be backed by the Builders' Exchanges, in which case the supply men could not be excluded as they formed so large a percentage of the membership. He held, too, that their interests were really the same and that the supply men would add strength to the organization. Mr. Anglin, also, was opposed to such a complete cleavage as Mr. Jackson suggested, though he admitted that a purely contractors' association would have advantages and that probably a considerable number of firms now outside the organization could be brought in. The question of trade discounts was also brought up, and the opinion was generally expressed that supply men who were members of an exchange should give a discount to contractor-members not allowable to outsiders, also that the trade in general should have preference over owners, while on the other hand contractors belonging to the Builders' Exchange should buy their supplies only from firms who were members. This collaboration between builders and supply men was considered one of the big advantages of having the supply men connected with the association. Returning to the question of organization, Mr. Anglin said that the chief weakness had been that there had been no general contractors' section of the Builders' Exchanges and was of the opinion that a more definite association of general contractors should be formed.

General Contractors Association Recommended

Finally the following resolution, moved by Mr. Anglin and seconded by Mr. Elgie, was adopted and presented when the three committees reassembled in the afternoon: That we, the general contractors' section of this preliminary meeting of the building industries of Eastern Canada recommend that a general conference of building contractors and allied interests, of Canada, be called to meet at Ottawa this fall, and further, whereas there are at present organized departments of sub-contractors and supply concerns, we recommend to the Ottawa conference that an organization of general contractors be formed either as an affiliated body or as a department of the Builders' Exchange. Both these clauses were carried unanimously, the supply men expressing themselves as willing to support and assist in any way possible, but pointing out that it was the part of the contractors to determine the form of the proposed organization.

The report of the sub-contractors presented by Mr. Gander, was as follows: (1) That only members of the various exchanges become members of the new organization, except those contractors in towns where no exchanges exist, and from these sources be formed a Dominion Exchange; and (2) it was thought that for the best relations between general and sub-contractors, the general contractor accept without delay the tender of sub-contractors who gave him tenders previous to the awarding of the general contract; (3) that a contract form be made which would be acceptable and binding between general and sub-contractors; (4) it was thought in the best interest of the trade that concessions be made or trade discount be given by supply men to general contractors and also to educate both them and the various unions that are recognized by various trades that it is against the interests of our craft that outsiders of the business of building industry be granted any price that places them on a level with us, leading up to the feeling that owners can ignore contractors with the thought of being able to get labor and material as cheap as the legitimate contractor.

The reports of the committees having been adopted, Mr. Anglin suggested that the next step was to form a definite conference committee with power to add to their number. He read letters from Mr. Thos. Adams, of the Commission of Conservation, who expressed very warm approval of the proposal regarding the conference and the formation of a contractors' organization, pointing out the possibilities in the way of helping to relieve the present acute housing situation. He also read a letter from Mr. Thos. Cooper, secretary of the Winnipeg Builders' Exchange, who said he would be pleased to do anything to help the project along. Mr. Cooper had been in Toronto previously, but unfortunately had left the city before the meeting was called.

Conference Committee Formed

Mr. Anglin's motion to form a conference committee was carried, and the following gentlemen were chosen to act upon it, some being included who were not present at the meeting: H. Elgie, Toronto; W. A. Mattice, manager of the Dominion Bridge Co. at Ottawa; Harry Hayman, London; J. P. Anglin, Montreal; J. D. Johnson, (Canada Cement Co.) Montreal; W. Ramsay (Pedlar People, Ltd.) Montreal; D. K. Trotter, Montreal; W. E. Dillon, Toronto; H. T. Hazelton, president of the Winnipeg Builders' Exchange, and Mr. Davidson, past-president of the Winnipeg Exchange. It was moved by Mr. Gander that Mr. Anglin be appointed chairman of this committee and Mr. Trotter, secretary. This motion carried.

Mr. Elgie read a memorial regarding the awarding of contracts for Canadian work to foreign contractors, which had been got up for presentation to the Dominion government. It was moved by Mr. Quinlan and seconded by Mr. Davidson that this memorial be referred to the Ottawa conference. Carried.

Oct. 22-23-24 was suggested as the date for conference, and on motion of Mr. Gander, seconded by Mr. Hyatt, this date was recommended to the conference committee.

Mr. Anglin, referring to the draft programme, pointed out that the last item suggested for discussion was: Trade papers and daily reports. He expressed the opinion that contractors did not take sufficient interest in the trade papers. They subscribed to them and read them over, but did not lend sufficient support in the way of writing articles. He thought that contractors could in this way be of great assistance to the trade papers and in assisting them, further the interests of the whole trade. The daily reports, too, should receive contractors' fullest support. Mr. Wright also spoke in favor of giving the trade papers all possible assistance.

Mr. Anglin moved and Mr. Smallpiece seconded, a vote of thanks to the Toronto Builders' Exchange for the welcome they had extended to the visitors and for the use of their rooms.

On the invitation of the Federal Administration of Railways of the United States, Mr. H. R. Safford, chief engineer of the Grand Trunk Railway, has been appointed engineering assistant to Mr. H. Holden, regional director of the Central Western district of the administration, who has jurisdiction over the traffic operations of about 50,000 miles of railroads. Mr. Safford joined the Grand Trunk in 1911 as chief engineer in succession to Mr. Howard G. Kelly, coming from the Illinois Central, where he was chief engineer of the maintenance-of-way department. He is a vice-president of the American Railway Engineering Association and in 1916 was elected a member of the Council of the Engineering Institute of Canada, which he joined in 1913, and a member of the American Society of Civil Engineers.

Pre-Cast Concrete Industrial Houses

WORKMEN'S houses constructed of "shop made" concrete erected recently for employes of the No. 5 plant of the Alpha Portland Cement Co., at Manheim, W. Va., are described in Engineering and Contracting. The houses vary from the 5-room semi-bungalow type to the cottage type of 6 rooms and bath. They were erected by the Simpson-Craft system, which permits the construction of reinforced concrete practically without forms, the greater portion of the work being pre-cast of minimum sections, made with the idea of using common labor in erection.

The construction consists of wall and floor slabs, together with belt and sill courses, floor beams and roof rafters made of standard sections and sizes for individual pieces. They may be assembled in any combination desired, so that while each building is made up of standard units, the general design may be varied, making it possible to produce a large number of buildings, using the standard units, but varying the exterior treatment.

The pre-cast sections of the buildings are made on casting tables or in moulds. This may be done either at the building site or in the yard or shop, and shipped to the site. If they are shipped, the sections may be packed in the fine broken stone, sand or gravel, and the latter may be used at the site as an aggregate forming the studs, which are field-cast and form the binding element for the buildings. All of the pre-cast members entering into the construction are so designed that the metal with which they are reinforced projects beyond the end or edge of the pieces. In assembling the pre-cast sections in the buildings, they are spaced at intervals on the walls, leaving a space between the two sides of sections, and are then clamped together temporarily by means of channel shaped wood or metal forms covering the two open sides of the intervening spaces and forming a pocket into which reinforced bars are placed. The inside face of these pockets has a series of holes spaced about 7 in. on centers, into which are placed large wire hairpins. The pockets formed by the forms are filled with concrete, forming the studs of the building and binding all parts together.

The reinforced concrete beams of the floor construction, which are pre-cast, rest on the top of the wooden forms of the studs, the ends of the concrete beams, with their reinforcements, projecting into the pockets. When the casting is complete, the end of the beam rests directly upon the stud, and is securely anchored.

Upon the removal of the field forms, heavy waterproof building paper is placed against the inside face of the studs, beginning at the ceiling line and working down toward the floor, lapping the paper 4 in. at each joint, and securing the edges to the window and door frames. After this paper has been applied, hy-rib self-centering or other ribbed lath, is placed with the ribs against the paper, forcing the ends of the hairpin through the opening in the lath. Through these openings is then placed a heavy wire or ten-penny nail, and the loops of the hairpin twisted down onto the wire, thus anchoring the lath permanently to the stud. The same method is used in securing the lath to the ceilings, though, if desired, the paper may be omitted.

Grounds for the securing of wooden base, picture moulds, etc., are secured to the lath, or "spot" grounds may be used for this purpose; the walls and ceilings are then ready for plastering. Studs for the interior partitions are all pre-cast. Reinforcement for these studs project from the upper ends, the stud being of full height between the top of the floor slabs on which it rests and the under side of the floor beams. Between the top of these studs and the top of the floor beams, a distance of 12 in., is cast a girder or plate, binding the ends of the floor beams together and distributing the load over the studs. This permits of the variations in spacing of the studs for door openings, etc.

Roofs may be formed in a manner similar to the floors, using slabs directly on top of the reinforced concrete rafters. Where cement tile is used for roofing, the tile may be laid directly upon the reinforced concrete roof slabs. For other types of roof covering, dovetailed lath are built into the top surface of the roofing slabs, forming nail spaces for the roofing material.

The foundation walls may be either a solid 8-in. concrete wall on top of a concrete footing, or formed in the same manner as the walls in the building above grade. In the latter case, however, the slabs forming the walls would be 2 in. thick instead of 1½, which is the standard thickness of the wall slabs.

Many designs of surfaces for outside walls may be obtained by the use of selected aggregate. The standard method is to finish the slabs under wood float, touching up the edges of the studs after they have been cast in the field.

Dry joints are used in assembling all the parts, though in casting the studs, all parts of the building are thoroughly grouted, forming a construction analogous to the placing of panels in the doors.

Sand, Gravel and Stone Placed on Non-essential List

Sand, gravel and stone have been placed by the U. S. Railroad Administration upon the list of nonessentials, except where shipments are for war industries purposes. The ruling was made Aug. 20, and hereafter open-top cars will not be available for transportation of such commodities, it is stated. The reason assigned for this order was that the war industries, army, navy and merchant marine have such large coal requirements that open-top equipment cannot be used for other commercial traffic. Such curtailment rules will, it is thought, tie up every sort of building activity, but officials are said to believe that this is the only method of staving off a winter shortage of coal cars. It is hoped that the maximum production of the mines can be handled during the winter.

The Canadian Department of Mines, Mines Branch, have issued Bulletin No. 20, in two parts. The second part is just now available and deals with "The Chemical Characteristics of Some Canadian Mineral Springs," by R. T. Elsworthy, B. Sc.

Unique Concrete Dam at Paris, Ont.

CONSTRUCTION has been started on a new mass concrete dam on the Grand River at Paris, Ont., for the Grand River Race Co. Plans and specifications have been prepared by T. Pringle & Son, Ltd., of Montreal and Toronto, and the contract has been awarded to the Foundation Co., Ltd., of Montreal.

There are several unusual features in the design of the dam. These were necessitated by the nature of the rock bottom, the owners' water rights and the danger of flooding adjacent areas.

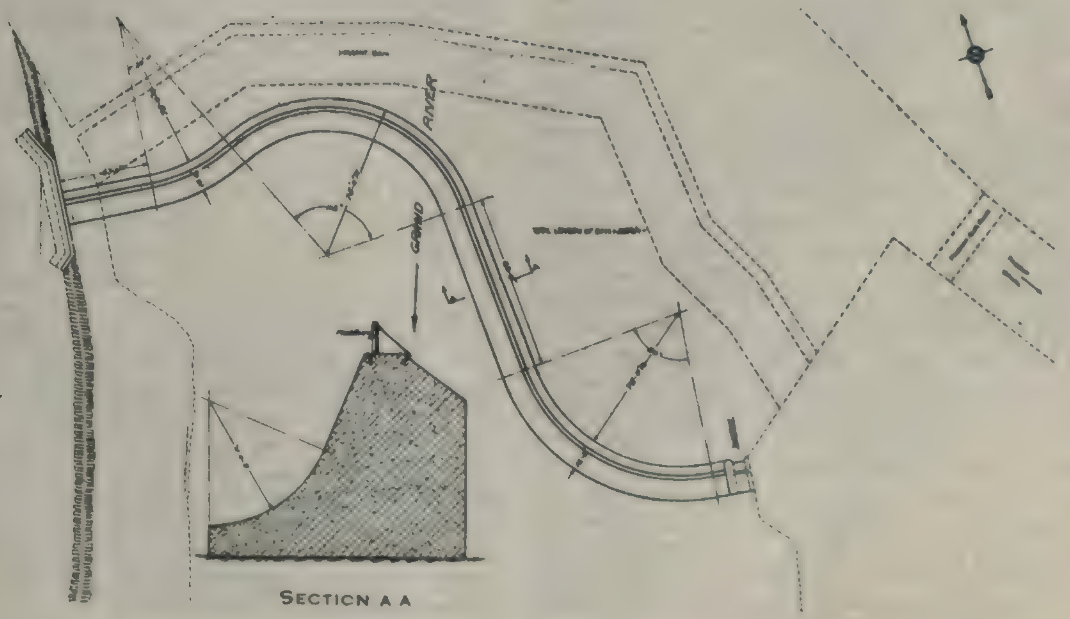
The dam is to be constructed in the form of a compound curve, as shown in the plan. This design was necessary to give sufficient length of spillway without encroaching on water rights not controlled by the company. The over-all length is 437 ft. The dam at the base is 16 ft. 6 in. and the height from the rock bottom to crest varies considerably, depending on the bottom. The minimum height will be approximately 15 ft., but this may in some places exceed 30 ft. In the event of a porous or soft rock bottom being struck the bed will be cleared and concrete placed in the forms with a sufficient number of pipes built in the mass to permit of a cement grout being forced in under pressure to fill up any cracks or voids in the bond between rock and concrete, or in the rock itself. This will prevent any leakage which might ultimately lead to serious wearing away of the rock bottom causing danger of failure.

The coffer, dam necessary to the construction has been designed with the idea of its being incorporated into the permanent structure. At the toe and the heel of the new dam the contractors purpose constructing coffer dams 4 ft. wide, from rock to well above water level. The excavation will be made, forms placed and the concrete deposited by means of deep sea buckets. The space between these coffer dams will be pumped dry and the concrete for the balance of the section of the dam will be deposited on the dry rock bottom.

To determine to the satisfaction of the engineers the nature of the bottom, a 50 foot section at the east end of the dam has been placed in a special coffer dam and the bed rock exposed for the full width of the base of the dam.

View of Existing Dam

The design calls for a six-foot sluice way at the east end of the dam for the purpose of clearing away any sand or gravel which might silt up toward the head-



Plan and Section of proposed Dam on Grand River gate. Provision has been made for flash boards 2 ft. high the full length of the crest. The abutment at the west end of the dam is carried much further into the bank than is the abutment of the existing dam. The present dam, abutments and gate house are shown in dotted lines in the plan.

The head gates are located at the head of a canal approximately 44 ft. wide, which carries the water to the power house, of Penman's Ltd., a distance of about a quarter of a mile.

Pit gravel will be used in the aggregate which will be in the proportion of 1 : 2½ : 5. The work is well under way and it is estimated that it will be completed before winter sets in.

Weighing Materials Saved Cement on Three Big Dams

By H. H. Hunt*

CONCRETE proportioned by weighing the cement, sand and gravel reduced the volume of cement used on three hydro-electric developments completed recently in Michigan and Minnesota. For a total of 130,000 cu.yd. of concrete placed, the cement used per cubic yard ranged from 1.18 to 1.23 bbl. Void tests and occasional changes of the relative weights of the component materials kept the mixture uniform. Making the operations of the mixer plant as nearly as practicable all-mechanical the labor force was not increased and there was no appreciable loss of time due to the more exact methods of proportioning by weighing. One design of mixer plant was used for all three jobs.

In 1917 and 1918 the following hydro-electric plants, for which the Fargo Engineering Co. were designing and supervising engineers, were completed and placed in operation: Wissota dam, near Chippewa Falls, owned by the Wisconsin-Minnesota Light & Power Co.; Junction dam near Wellston, Mich., and Foote dam near Oscoda, Mich., the two latter dams being owned by the Consumers Power Co. Wissota dam was of 60-ft. head and comprised 61,000 cu.yd. of concrete; Junction dam was of 50-ft. head and contained 47,600 cu.yd. of concrete, while Foote dam was of 35-ft. head and the volume of concrete amounted to 21,000 cubic yards.

The concrete specifications for these three developments were drawn in such a manner that the proportions were dependent upon the voids found in the sand and stone, and on account of the varying values of voids to be expected it was considered desirable to have a ready means of changing the relative amounts of sand, cement and stone. It was, therefore, decided that all material should be weighed so that any desired proportions could be obtained with a minimum of trouble. While this method has been used previously in a few cases, because of the exceptional success obtained here, a description of the plant layout, together with an outline of the steps involved in the determination of proportions, is of interest.

The following description refers especially to the Foote dam operations. Sand and stone from the dump cars were unloaded into the boots and elevated to the overhead bins by means of continuous bucket elevators 71 ft. 6 in. long, each elevator being provided with an individual motor drive. The capacity of the storage bins was 80 cu. yd. of sand and 160 cu.yd. of gravel, it being considered advisable to have enough material in storage so that a break down in the transportation system would not seriously interfere with the continuity of concreting operations.

As an additional insurance against shut downs, storage piles of sand and stone were provided adjacent to the mixing plant and a stiff leg derrick handling a clamshell bucket was so located that it could take material from storage and place it in the boots of the bucket elevators. The use of these storage piles made it possible to transport screened sand and stone at a more uniform rate than could have been done if dependence had been placed upon the storage capacity of the bins only, inasmuch as at such times as the mixing plant was not in use, transportation of materials from the screening plant would have been stopped when the bins were filled. As it was, a uniform output at the screening plant could be maintained, excess material over that used on any given day by the mixing plant being placed in storage, and, conversely, being taken from storage on those days when the output of the mixing plant exceeded the capacity of the screening plant. Steam pipes were provided in each bin to prevent freezing of sand and stone in cold weather.

When the mixer plant was in operation cement was loaded onto a push car and transported to a dumping pocket located over the lower end of a belt conveyor. The sacks were emptied into this pocket and the empty sacks were stored in a small shed nearby. Before being bundled for return to the cement mill the sacks were placed in a cleaning machine and thoroughly shaken. The dumped cement was taken by the belt conveyor and discharged into a bin located at the front of the sand and stone storage bins and directly above the charging hoppers of two cube mixers. Sliding cut-off gates were provided on the cement bins and proved very satisfactory.

The charging hopper of each mixer was supported on the framework of a Standard hopper scales provided with a four-beam charging box. Three of the beams were graduated to 1600 lb. by 5-lb. intervals and one beam to 3000 lb. by 10-lb. intervals. In operation, only three of the beams were used; one each for cement, sand and stone. A testing engineer was responsible for setting the scales to give proportions which tests showed were required under the specifications, and after setting the beams the charging box was locked.

The various scales were placed in operation by means of levers projecting through one end of the box. Under this arrangement the man on the charging platform would throw a lever to place the beam for stone in operation and would then admit stone to the charging hopper until the beam balanced, when the cut off valve was closed. In the same manner cement and sand were added. If through carelessness too much stone or sand was added, a correction was made by means of a plus or minus attachment so that each batch contained the computed amount of cement.

Water was supplied to the mixers from an elevated tank which was provided with an adjustable discharge pipe by means of which the amount of water supplied to the mixer could be regulated or maintained constant. A steam connection was provided by means of which water could be heated in cold weather.

The number of men required for operating the mixing plants was as follows: Operating cement conveyor,

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*Fargo Engineering Co., Jackson, Mich., in Engineering News Record.

1 man; sand and gravel bins, 3 men; charging mixers, 2 men and operating mixer, 2 men. In addition there was a gang of men who transported cement from storage to dumping pocket.

After being dumped into hopper bottom cars the concrete was hauled or pushed to the forms on a narrow gage track on an overhead trestle, though some concrete was spouted directly into place. A kerosene burning locomotive was used for hauling cars and proved entirely satisfactory.

Costs of plant construction, including equipment for proportioning, are given for the Junction dam plant as follows, based on 1916 prices:

Portable Screening Plant

Labor:	
Framing timbers, 140 hr. at 35c.	49.00
Erecting bins, 1,210 hr. at 35c.	423.50
Placing screws and motors, 150 hr. at 35c.	52.50
Installing elevator (estimated)	50.00
Total labor	$575.00
Material:	
9,200 ft. B.M. timber at $33	303.60
3,500 ft. B.M. plank at $24	84.00
1,130 lb. bolts and rods at 6c	68.00
780 lb. sheet metal at 8c	62.40
2 bin gates at $22	44.00
8 track wheels at $20	160.00
2 revolving screens, 42 x 14 in.	1,018.00
1 bucket elevator, 35 ft. centres	830.00
Total material	$2,570.00
Grand total	3,145.06

Bins and Mixer Plant.

Labor:	
215 hr. framing timbers at 35c	$75.00
1,945 hr. erecting bins at 35c	875.75
780 hr. erecting bins at 25c.	
120 hr. building house at 35c	57.00
60 hr. building house at 25c	
240 hr. setting scales and mixer at 35c.	114.00
120 hr. setting scales and mixer at 25c	
Concrete footings, 27 cu. yd.	28.50
180 hr. heating pipes in bins at 30c.	99.00
180 hr. heating pipes in bins at 25c.	
Elevators and belt conveyors (estimated)	200.00
Total labor	$1,458.50
Material:	
Pipe, etc., for heating system	196.00
2,700 lb. sheet steel at 8c	216.00
3,500 lb. bolts and rods at 6c	210.00
4 bin gates at $22	88.00
Concrete for footings	140.00
14,000 ft. B.M. plank at $24	336.00
15,500 ft. B.M. timbers at $33	511.50
Total material	$1,697.50
Equipment:	
71½ ft., 18 in., 4-ply belt	400.00
3 No. 4 elevators	2,000.00
2 No. 1618 Standard hopper scales	280.00
2 Mixers	2,300.00
Total equipment	$4,980.00
Grand total	$8,136.00

It should be noted that the above plants are so built that they can be used on future work at slight expense for moving and re-assembling so that the figures given do not represent the amounts to be charged against any one development.

Sand and stone for all three developments were obtained from nearby deposits of bank gravel of which 2 per cent was retained on a 1½-in. screen and 40 per cent on a ¼-in. screen, and 58 per cent passed a ¼-in. screen.

All gravel was excavated by steam shovels or drag line excavators and screened into sand and stone bins, using vibrating screens in one plant and revolving screens for the other two. Though the vibrating screens required more repairs than the rotary screens, the results obtained, especially in damp weather, were more satisfactory, as it was found almost impossible to keep the rotary screens from clogging after rains. Portable screening plants were used at two points. Electric power operated belt conveyor and screens.

Cement in cloth sacks was used for the Michigan jobs, being unloaded from cars directly into a storage shed having a capacity of 10,000 bbl. and located in close proximity to the mixing plant. Each carload was kept in a separate pile and marked with car number and date received. Bulk cement was considered, but a decision was made in favor of the use of cement in cloth sacks because it was found that it would be easier to obtain the latter from mills within a reasonably short shipping distance. At Wissota dam, however, bulk cement was used with very satisfactory results as to economical handling.

A testing engineer, reporting to the resident engineer, was placed in charge of void tests from which concrete poroportions were computed. After setting the scale beams to produce the proper proportions this assistant engineer made frequent inspections to make certain that mixer attendants used proper care in balancing the scale beams. As all work was being done by the owners, the presence of a concrete inspector at the plant continuously was not considered necessary, but such inspection should ordinarily be provided on contract work. Frequent tests were made of voids in sand and gravel as they arrived at the job and when it was found that void precentages had changed, the mixer scales were re-set without interference with concreting operations. This method of charging the mixer hoppers worked out very well and a much more uniform mixture of concrete was obtained than was possible where proportioning was done by levelling to marks in the charging hopper.

Samples of concrete were taken from the forms at frequent intervals and poured into 8-in. cylindrical molds 16 in. long. These cylinders were stored in damp sawdust or sand and were later sent to a laboratory for tests of compressive strength when thirty days old. The results of these tests were satisfactory and showed that the methods of proportioning and mixing were such as to insure good concrete. Occasionally a low crushing strength would be shown, but it was usually found that this was due to the presence of a stone pocket in the cylinder. In addition to taking sample cylinders for testing, frequent 1:3 briquette tests were made at the job as a check on cement tests made before shipment.

In order to determine the advisability of using water-proofing material in concrete subjected to water pressure a series of tests were made of the permeability of concrete mixed according to different proportions. Blocks of concrete were made, nine different proportions being used. The tests showed that there was no reason to expect seepage under heads up to 50 ft. if mortar for concrete was mixed even as lean as the proportions of 1:2-7/10 by volume. The tightness of the finished concrete which is subjected in some cases to a head of 40 ft. is a satisfactory confirmation of the conclusions resulting from the permeability tests on small samples.

The screening and mixing plants described were used on work involving the mixing and placing of approximately 130,000 cu. yd. of concrete. It has been demonstrated that proportioning by void determination insures excellent concrete with less cement than required to obtain concrete of equal quality with predetermined, fixed proportions. The amount of cement used per cubic yard of concrete ranged from 1.18 to 1.23 bbl. on the several jobs where use was made of the proportioning methods described above. The use of scales for charging the super-hoppers of the mixers was essential to provide for convenience in changing proportions from time to time, and furthermore it made almost certain the absolute uniformity of successive batches, since it obviated the difficulty of measuring volumes by bringing the several materials to fixed points in a hopper.

While the quantities of concrete involved are greater than found in the average case, there is no question that void determination and the use of scales would work out very satisfactorily on comparatively small jobs. In cases where it is desired to adhere to the usual method of arbitrarily selecting fixed proportions the use of scales would still be of great value in insuring uniformity of mixture and preventing disputes as to the use of the proper amount of sand, stone or cement.

Heating and Piping Systems

COMPETENT engineering advice should be obtained for important new installations or reorganizations of heating systems, especially of piping work. In certain industries, textile mills for instance, where a large amount of piping is required poor design and arrangement is responsible for great losses. An instance is recalled of one mill that has lost $100,000 in waste of fuel in the last ten years for want of a good piping job.

In many heating and sprinkling installations the cost of piping will amount to 10 per cent of the cost of the building. In some cases, such as dry rooms, this cost may be increased to 15 per cent or over, of the building cost. In bleacheries, dyehouses and buildings of that nature the piping cost runs up considerably due to the large amount of piping and numerous valves that are used on the different machines.

The practice of sending plans of buildings to different contractors and asking for prices on complete guaranteed systems should, in the writer's opinion, not be encouraged. The highest bidder will quite likely have the best and most economical layout but it is possible that it will be rejected in favor of a competitor who puts in a lower bid for an inferior system.

The high pressure steam heating systems have become, more or less, obsolete and are replaced by low pressure installations with a vacuum in the return lines. The maintanance cost of a low pressure system is greatly reduced in comparison with the upkeep of a high pressure system on account of the reduction in valve trouble and the elimination of leaking joints. With the vacuum system, providing it is kept in good order, the coils will not become clogged and a room can be kept at an even temperature.

The points to be considered in the design of a heating system are:

1. The amount of radiation required and the most suitable location for the heating units. The location of the units will determine the style—whether a built up pipe coil or a radiator shall be used, also whether wall or ceiling units will have to be used.
2. Suitable size of feed lines.
3. Efficient traps.
4. Suitable size of return lines.

A vacuum of about ten inches will always keep the coils free from air and water. The return lines should always be piped so that the condensation will flow back to the pump by gravity. Be sure to have a valve placed on this line near the pump so that the return water may be run off at any time if it should be necessary.

Ceiling coils are carried on hangers of various designs and wall coils are secured by wall brackets of numerous types. In placing hangers for ceiling coils be careful to see that the roof is not pierced causing leaks.

All underground sprinkler mains and water service pipes are usually of cast iron when the larger sizes are used. The smaller service pipes, below three inches, should be of galvanized iron.

Steam pipes, when it is necessary to run them underground, are encased in cypress boxes or tile pipe.

Too much stress cannot be laid on the subject of properly attaching valves. A bad practice sometimes followed in screwing pipe and brass valves together, is in using extra long pipe wrenches and placing them on the hexagon farthest from the pipe end which is being connected. When this is done, no matter how heavy the valve body may be, it will tend to spring the seat and place same out of line. In screwing on to pipe always close the valves tight, so as to make them as rigid as possible.

Piping should be cleaned out before being screwed into position and the line should be blown out after the valves are in place. Unless this is done loose scale or metal chips remaining in the pipes, will injure the valve seats or discs, causing leaks and necessitating re-grinding, re-seating or removal of the discs. A valve should not be permitted to carry the weight of a line of piping as this may spring the seat. A properly placed hanger has often remedied the difficulty of a leaky valve.

Insist that the entire piping system is thoroughly inspected before it is accepted by you as there are few features of your equipment likely to cause more constant worry and continuous trouble than a poorly erected piping job.

New Books

Modern Management Applied to Construction—by Daniel J. Hauer, construction economist and consulting engineer; McGraw-Hill Book Co., Inc., publishers. The author's experience as a construction economist covering the past decade, has taught him that scientific management is applicable to construction, and this treatise is the result of his experience. It is offered to the profession in the hope that it will assist engineers and contractors to build up and strengthen their organization for greater efficiency, thus making it possible to earn larger profits. The scope of the work may be gathered from the following chapter headings: What is scientific management; old versus new management; principles of modern management; finances and efficiency; fundamentals in choosing type and amount of plant; the application of motion and time studies; application of modern management; cost keeping and book-keeping; systematizing construction; the effect of modern management upon workmen. 187 pages; size 6 x 9 in. Price $2.50.

BRIDGE AT LYONS NAMED IN HONOR OF PRESIDENT WILSON.

Arch Structure with Twin Masonry Ribs Carrying Reinforced-Concrete Floor Peculiar to French Design.

BASTILLE Day this year was celebrated in Lyons, France, by the dedication of a new masonry arch bridge, across the River Rhone, to which has been given the name Pont Wilson in honor of the President of the United States. It is the latest example of a French type of bridge that combines all of the recognized architectural qualities of the stone arch with many of the structural advantages of the reinforced-concrete floor. The bridge is noteworthy, too, because it has been carried to successful construction through the past four years of war. The following description appears in a recent issue of Engineering News Record.

Lyons, like Paris, has many bridges, crossing both the Saone and the Rhone Rivers, which run through the city. The latest bridge occupies the site of an old suspension bridge built in 1839. This bridge was taken down in 1913 and replaced temporarily with an adjoining wooden trestle bridge which carried the street traffic during the past five years. Work was started on the foundation of the new Wilson bridge in October, 1912, and rapid progress was made until the outbreak of the war. Since then construction has been steady but slow. The bridge was opened, as stated, on July 14, of this year.

The Wilson bridge consists of four elliptical arches, 138 ft., 148 ft., 161 ft. and 148 ft. in span, with an approach arch at each end, making the total length of the bridge 743 ft. It carries a roadway 36 ft. with railway tracks, and two sidewalks each 15 ft., making a total width of 66 ft. Except for differences in dimension the arches are all similar, each arch being composed of two independent ribs, 16½ ft. wide and 36 ft. apart, resting on independent piers which extend down to a common pier footing. While the piers and the arch ribs are of cut stone spandrel piers, which are braced longitudinally by continuous concrete jack arches. The concrete fill also extends from the last spandrel pier, about over the haunch to the crown. These jack arches have cut-stone fascia arches on the outside walls of the arch ribs.

The floor system comprises floor-beams at each spandrel pier spanning the twin ribs and carrying a reinforced-concrete floor. These floor-beams, which rest on the concrete fill near the crown and on the spandrel piers for the remainder of the arch, are deeper between the arches than they are at their supports on the ribs. They are heavily reinforced, and have panels of concrete removed from the shaft of the beam between the stringers of the floor, to save weight. The floor itself is a slab 3½ in. thick spanning between 8 x 18-in. longitudinal stringers framing into the floor-beams over the full-thickness section—that is, above the shafts in the paneling. The roadway itself is of creosoted block, while the sidewalks are of asphalt. An ornamental railing of cut stone finishes the architectural appearance.

Except for difficulties in getting labor and material during war times, there were no extraordinary incidents in the construction. The foundations were put in under compressed air in the sand-and-gravel bottom of the Rhone. The formation here had been made quite familiar by previous construction, and no difficulty was experienced in sinking the caissons to the necessary depth of 30 to 40 ft. The arches, which were of different lengths on account of the channel necessity, are built on steel centres supported from six timber pile platforms in the river. Variations in the blocking under the lagging permitted the use of the same forms on all four arches. They were lowered by sand

Wilson Bridge at Lyons. France.

boxes on platforms. Arch ribs were set up in two rows of stone at the crown and three at the springing line, and staggered in plan to guarantee bond. The loadings were spaced along the arch ribs so as to insure the least deflection in the centering. Control of all the stone-setting and concreting was had from a gantry crane which travelled on tracks running on each side of each arch rib.

The bridge was built by force account under the direction of M. Chalumeau, chief engineer of the city of Lyons. Its total cost amounts to about 2,150,000 francs, or $430,000. A description of the bridge, from which many of the above figures are taken, appeared in Le Genie Civil for July 13, 1918.

Some Hints on "Rope and Tackle"

ROPE is in constant use on building work and, in the interests of safety, the man on the job should be thoroughly acquainted with its proper selection, care and employment. The following short article on "Rope and Tackle" by John Upton in a recent issue of the National Builder, gives some interesting hints in this connection:—

The handy man to some extent is familiar with the use of rope and tackle, but is always on the lookout to learn more about this useful device.

For most work a single and double block, or two double blocks, taking a ¾-in. rope, will be most useful. The rope should be of good length, especially if the blocks are double or triple. It may be well to get both blocks with beckets so that later you can use a double block in place of the single, or even a triple one. Such a tackle may be used to lift a stick of timber to place; or perhaps one may be needed at each end. It will also help in putting up timber frames and trusses and in hauling up rafters.

In hauling a heavy object on the ground, or in moving a building, it makes a difference which way the tackle is hooked. It should be so fitted up that the rope on which you pull runs from the object to be moved, not toward it. Try this and see.

Sometimes you can gain by hitching a small tackle onto a large one to draw by. There is a chance of putting too much strain on the large one, so one should use judgment. Everyone should learn to tie such knots as the timber hitch, half hitch, clove hitch, bowline and square knot, and to splice a rope. They are all easy after one gets the idea, and a little practice will make one familiar with them.

Care should be used in buying ropes. A good hemp is hard yet pliant, of a yellow or greenish gray color, and has a sort of silver or pearly lustre. A dark or blackish color indicates that in the process of curing the hemp has suffered from fermentation. Brown spots tell us that the fibers were wet when spun, and are weak. Sometimes good hemp is used for the outside and a poor quality for the inside. This can be detected by making an examination of the end of the rope. Ropes which have a wooly appearance, or where the ends of the fiber protrude, should not be used for important work.

All ropes should be protected from dampness. They can be soaked in a solution of bluestone (copper sulphate). Have your rope dry. Let it lie in the bath for three or four days and then dry thoroughly. Ropes are frequently allowed to unravel at the ends and thus become shorter. If a crown were woven at the end, or even a piece of twine wrapped around it, this might easily be avoided.

When a rope runs over a pulley it is constantly bending and straightening, causing the fibers to chafe at the centers. The smaller the pulley the worse this is. One should use a pulley not less than eight times as large in diameter as the rope, and larger would be better. Ropes used in tackles or pulleys will give more service if they are reversed occasionally. For such important work as hoisting tackle and steeple jacks it will be better to use a four-strand woven around a cord. This costs more than a three-strand but is worth more. The strands are of such shape that they give more strength, weigh more to the foot and wear longer, as they are kept away from the center and so chafe less.

To untie a hard knot in a rope or strap, hammer it on all sides with a piece of wood, then dip it in boiling water for a moment or two. A little soap will help. With a sharp pointed instrument the knot may now be picked loose.

Knots will weaken a rope. The more bends there are and the shorter they are the worse this is. Some of the most simple knots are the most useful. A crown knot is merely a splice of rope at the end, back on itself, to prevent unraveling.

The principle of a knot is that no two parts which would move in the same direction if the ropes were to slip should lie alongside of each other. Another is that a knot must be so devised that the tight part of the rope will bear on the free end in such a manner as to pinch and hold it.

In making knots the bends in a rope are the bight, the loop or turn, and the round turn. A bight is made by a simple bend in the rope, like the letter U. A loop is made by passing the rope around an object, such as a post or stick. A round turn is another turn of the rope. To remove a snarl in a rope, draw out one end as far as possible, then open the center of the snarl so it can form a hole around this free end and seize the entire bundle, forcing it through this hole, putting the outside through first. This will add to the free rope and if continued will unravel any tangle.

Removing Old Plaster.

For removing old plastering, scarcely any tool is more effective than a garden hoe. It will be necessary, of course, first to prepare the way by exposing a small area. After that the blade of the hoe may be hooked under the loose plaster which may be torn away in relatively large flakes. For scraping out the plaster that clings between the lath a mason's trowel is undoubtedly the most efficient tool one can use, though if the plaster sticks tenaciously the flate blade of a spade may be used to advantage.

Wooden Shoes Used on Concrete Mixing Boards.

The well-known tendency of cement to destroy shoes was overcome on some work in South America, by the use of shoes with heavy wooden soles. Concrete was being mixed by hand and the laborers could not be kept on the job because the cloth slippers with rope soles usually worn by them soon became saturated with cement-impregnated water. The difficulty was overcome by furnishing them with wooden-soled shoes with leather tops.—A A. Northrup in News-Record.

The Deterioration of Concrete Due to Alkali Conditions

IN recent issues of the Contract Record, notably Feb. 13 and March 20 of this year, we have published discussions of the effect of alkali on concrete. The first article mentioned outlines the result of investigations carried on by the U. S. Bureau of Surveys and the U. S. Bureau of Standards and our issue of March 20 contained an article by Mr. J. F. Greene, construction engineer of Carter-Halls-Aldinger Co., Winnipeg, describing conditions in Western Canada. Further data on this interesting subject was recently presented before the Engineering Institute of Canada, by a committee appointed by the Calgary Branch. This committee consisted of Geo. W. Craig, city engineer, F. C. Field, chemist, F. W. Alexander, division engineer, C.P.R., and A. S. Dawson, chief engineer, department of natural resources, C.P.R., all of Calgary. The report runs as follows:—

As far as published print would indicate the conditions arising from alkali-affected concrete and the theories regarding such are of comparatively recent date. The first literature seen by this committee was published in 1908 by the Montana Experiment Station; and since that time the subject has been investigated by the Experiment Stations of Colorado and Wyoming, the United States Reclamation Service, and the United States Bureau of Standards.

The most usual causes of the disintegration of concrete may be summarized as,—

1.—Bad Workmanship.
2.—Poor and unsuitable materials, and badly graded and proportioned mixtures, including the amount of water used.
3.—Alternate wetting and drying out, and alternate freezing and thawing out.
4.—Destruction and removal of the protecting outer skin from various causes.
5.—The presence of an excess of alkali salts.

It is unnecessary to mention the effects of frost before setting, errosion of the skin by excessive velocities and other mechanical agencies; which to a great extent can be provided against during construction and subsequently, by various well known methods.

The following remarks apply to various structures in the city of Calgary, and in the country extending east between Calgary and Medicine Hat—all of which have come under the observations of the writers.

The aggregates were mostly (1) Bank run gravel, (2) River gravel. The cement was all Western brands, which had passed standard tests; and the water was from rivers and local wells. The workmanship was good, and all done under close supervision. The worst conditions have been found on types of structures whose design has necessitated their being back-filled on one side, and subjected to heads of ground water from the same direction—and at or below the original ground surface. These conditions seem to be aggravated where the structures are subjected to dry and wet surroundings—exposed to sun and shade in the winter months—excessive velocity—and where alkali salts are most in evidence and the ground wet.

The fact that the deterioration starts on the surface, extending inwards, and that the water being carried by the structures has analytically been shown not to be responsible for the trouble, would indicate that the deterioration was primarily caused by the ground water, and its effects on the concrete. These effects vary in degree from the spalling off of the surface in what results in a pile of loose gravel below, to a condition where the mass becomes of a slimy consistency like so much lime mortar or mud. As a rule samples in what might be termed an intermediate stage get harder if permitted to dry out in the air, when they become coated with white powdery salts.

These observations have come from a committee who as individuals have had direct charge of over 250,000 cubic yards of concrete. The majority of the work is in first-class condition; and the disintegration of a very small portion of the whole must be due to some extreme local conditions which exist at certain points where failure is taking place. The verdict has been pronounced by one of the most experienced chemists in the Western United States, Mr. Edmund Burke of Bozeman, Montana, who had been working with one member of this committee, that the disintegration is caused by alkali salts, and that the sulphates are the most active. This is the opinion of most of the men of the United States who have been working on the same problem for several years; although there is a difference of opinion as to just what change takes place. Either the disintegration is due to the formation of soluble compounds which are leached out of the concrete, leaving it inert, or it is due to the disruption caused by the crystallization of the salts in the pores, or by chemical action of the substances in solution with the constituents of the concrete.

A brief study of the geological conditions of this part of Alberta shows that through the cretaceous period great deposits of clay were laid down in marine water, this deposit subsequently forming shale which contains considerable alkali salts. During the Tertiary age glaciers swept over this country, covering the clay to a greater or less depth with the present soil. Since the glacial epoch, erosion has carried many a portion of the glaciated material, and in some places, especially ravines and depressions, has left the shells exposed.

It is therefore probable that this shale and the clay soils derived from this shale carried the alkali salts found in several localities in which the structures were built. The glaciated soil gives little or no evidence of the pressure of alkali. The structures placed in glaciated soil are therefore subjected to the least amount of alkali salts; while those placed in soils laid down during the cretaceous period are subjected to the greater amount of alkali salts. This is probably the reason why some of the structures are in perfect condition, while others are deteriorating quite rapidly.

Samples of soil were taken for analysis where concrete was failing, together with concrete both sound and showing different degrees of disintegration, for the purpose of determining whether the soil adjacent to the structures contained sufficient alkali salts to account for the injury; and also to determine whether these salts had actually reacted with the concrete. The sulphates would seem to be by far the most active salt found, and it is generally admitted that magnesium sulphate is the most active salts found in the alkali soils. The samples of soil were, therefore, analyzed for sulphates, which were subsequently calculated to sulphuric anhydrate (SO_3), and a composite sample for magnesia which was caluclated to magnesia oxide (MgO). Recent investigations by the United States Bureau of Standards show that porous tiles, due to lean mixtures or relatively dry constituencies, are disintegrated when exposed to water or soils containing alkali salts in quantities of 0.1 per cent or greater. The Montana Experiment Station's work indicated that good mixtures of concrete were disintegrated when exposed to soil containing 0.4 per cent or more of alkali salts. The soil must, however, contain sufficient moisture to allow for movement of the salts. Any condition which will tend to carry the salts from the soil to the concrete will hasten the disintegrating action, and lessen the per cent of alkali necessary to cause destruction.

Table No. 1 shows the analyses of various samples of soil which were in contact with concrete structures where trouble has been experienced.

Table No. 1.

Sample No.	SO_3%	MgO%	CaO%
3	5.700	1.70	0.523
8	0.445	Comp. 0.63	0.210
12	1.190		
13	0.840		
15	1 930		
17	0.036		
19	0.888		
N.B. 1	0.690		
2	0.388		
3	0.543		
4	0.920		
5	0.765	N. B. Comp.	
6	0.945	0.066	0.037
7	0.566		
8	0.453		
9	0.508		
S.H. 1	0.386		
2	0.690		
3	0.588		
4	0,573		
5	0.550		
6	0.630	S. H. Comp.	
7	0.383	0.023	0.197
8	0.680		
9	0.468		
10	0.269		
11	0.194		
12	0.224		

Inspection of this table shows that there are sufficient alkali salts in all samples analyzed to have a destructive effect on concrete of excellent quality. The samples of concrete were analyzed for lime (CaO), sulphates (SO_4) and magnesia (MgO). The purpose of these determinations was to ascertain if the percentages of sulphates and magnesium were greater in disintegrated concrete than in sound portions of the same structure.

A study of Table No. 2 shows that the per cent of sulphates is higher in the disintegrated concrete than in the sound concrete from the same structure; and this is well illustrated in samples Nos. 1 and 2, and Nos. 5 and 5a.

Sample No. 1 shows only a slight disintegration, but contains a higher per cent of sulphate than sample No. 2, which had not been acted upon by alkali. Sample No. 5 shows a greater degree of disintegration than sample No. 1, and contains a greater per cent of sulphates. Sample No. 5a contains a greater per cent of sulphates than sample No. 2. Samples Nos. 2 and 5a were taken from apparently sound concrete, although it is quite possible that sample 5a represents concrete which was slightly acted upon.

Table No. 2.

Analysis of concrete, showing per cent of lime (CaO) and sulphuric anhydride (SO_3) and the ratio of CaO to SO_3:

Sample No.	CaO	SO_3	SO_3		CaO
1	14.55	1.02	7.00	:	100
2	15.80	.30	1.90	:	100
4	9.44	2.44	25.8	:	100
5	12.56	4.65	37.0	:	100
5a	15.23	.72	4.73	:	100
6	12.84	3.90	31.6	:	100
7	12.11	2.85	17.0	:	100
9	12.96	3.65	28.2	:	100
10	15.41	.85	5.50	:	100
11	16.88	.52	3.09	:	100
14	15.52	.85	5.45	:	100
16	13.47	.44	3.26	:	100
18	14.89	.37	2.50	:	100
18a	21.60	.28	1.30	:	100
20	18.53	2.35	12.70	:	100

Analysis of the same brand of cement as that used in the structures from which samples 1 and 5 were taken shows that the ratio of sulphates and hydrate of lime varied from 174 per cent SO_3 to 100 per cent CaO to 3.32 per cent SO_3 to 100 per cent CaO. These ratios show less sulphate than was found in sample No. 5a.

It will be noted that there were smaller percentages of lime in the samples of disintegrated concrete than in the samples of sound concrete; and there is probably a slight leaching of lime from the disintegrated concrete, which would decrease its per cent. A still further and more pronounced decrease in the per cent is brought out in the accumulation of sulphate in the disintegrated concrete. The analysis of sample No. 6 shows clearly the effect which sulphates have on concrete, where we have a ratio of 31.6 per cent. of SO_3 to 100 per cent CaO.

Samples Nos. 7, 9, 10 and 11 were taken from a siphon. Samples 7 and 9 were taken from the outer surface of the siphon and show an accumulation of sulphates. Sample No. 11, taken from the inside of the pipe, shows no accumulation of sulphates. Sample No. 10 represents the average material in the pipe barrel. It is interesting to note that the analysis of sample No. 10 shows a greater per cent. of sulphates than sample No. 11, but a much less per cent. of sulphates than samples 7 and 9. The analysis of samples No. 11 would indicate that little, if any sulphates, were being taken from the water carried by the pipe. Sample No. 14 shows no disintegration, and the soil adjacent to this particular structure did not contain sufficient alkali to cause serious results. The same remarks apply to samples 16 and 18.

The following report on the analysis of stalactites, taken from a large structure, should be interesting. This information is from O. E. Harder of the Construction Materials Research Laboratory, Lewis Institute, Chicago, and was corroborated in by Mr. J. A. Freeman, Engineer, Technical Division, Portland Cement Association, Chicago.

Analysis.

The chemical analysis of the sample of stalactite from Mr. Edmund Burke, gave the following results:

Calcium Oxide (CaO)	58.9 per cent.
Carbon Dioxide (CO_2)	29.5 per cent.
Loss on ignition (CO_2 H_2O)	40.9 per cent.
Iron and Aluminum Oxides Al_2O_3 plus Fe_2O_3	0.5 per cent.
Magnesium Oxide (MgO)	None.
Sulphates (SO_4)	None.
Reaction with Phenolphthalein	Decidedly alkaline

Combining the above radicals so that the carbon dioxide (CO_2) is combined with the calcium oxide (CaO) to form calcium carbonate ($CaCO_3$) there is left an excess of calcium oxide which, when calculated to $Ca(OH)_2$ gives 28.2 per cent. The calculated composition of the stalactite is:

Calcium Carbonate ($CaCO_3$)	67.1 per cent.
Calcium Hydroxide $Ca(OH)_2$	28.2 per cent.
Moisture by difference	4.7 per cent.

Conclusion.

The above results indicate that lime is being leached out of the cement. Some of the calcium carbonate may come from the water which is coming in contact with the concrete. A water which contains lime and a considerable amount of bicarbonate (HCO_3) as this one does, may be expected to form stalactites due to the loss of carbon dioxide and the precipitation of calcium carbonate upon coming in contact with air and reduced pressure This, $Ca(HCO_3)_2 = CaCO_3 H_2O$ plus CO_2. However, it seems impossible that the calcium hydroxide $Ca(OH)_2$ could have been formed from the water. The water percolating through the concrete becomes saturated with calcium hydroxide, which is slowly deposited, forming the stalactites. Also, part of the calcium hydroxide deposited would be converted into the carbonate, due to the action of the carbon dioxide in the air. Thus, $Ca(OH)_2$ plus $CO_2 = CaCO_3$ plus H_2O.

If the leaching out of the lime continues and shows a tendency to increase, it may be expected to have a harmful effect on the concrete. On the other hand, if the leaching out of the lime shows a tendency to decrease, due to a filling of the pores in the concrete, slight or no harmful effects to the concrete should result.

In view of our observations the conclusion has been reached that we must get away from the idea that any ordinary foreman can handle concrete, the way it must be handled. We have already revised our specifications demanding better workmanship—better materials where possible—richer mixtures with less water, and closer supervision by men who know the concrete business as a specialty.

We have already adopted the practice of using water, gas tar and coal gas tar on the surface of walls which will be subjected to conditions which are known to cause trouble; but in this connection it should be noted that any asphaltic preparation becomes inert when subjected to alkali salts, and that practically pure tars must be used. The best possible drainage facilities are also being provided at all structures built.

We have also started in on an elaborate series of experiments on concrete blocks 10 in. x 10 in. x 2 ft. 6 in., using both Western and Eastern cements, with the following aggregates:—

A. Standard, e.g. screened, washed and graded.
B. Bank run, washed.
C. Bank run, natural.

Each in a 1-2-4 and 1-1½-3 mixture. The cement and water will be chemically analyzed, and put under standard tests. Sand and gravel will be analyzed chemically and physically. The blocks will be 1—Plain. 2—Treated with soap and alum. 3—Treated with water gas tar and coal gas tar. They will be placed in the best and worst localities that can be found, and will be systematically examined and tested over a period of three years or longer. It is anticipated that these investigations will help us as well as others who may work along the same lines, and be of value to the community at large. They may result not only in getting at the root of the trouble, but enable us to determine on a mixture and class of work that will stand up and be most economical as well.

In conclusion, a brief summary of the original of alkali salts will be of interest to members who are not practical chemists.

The "alkalis," as they are called, are carried into the soil with the other elements, which form its inorganic bulk by the pulverization of rocks and minerals; the decomposition of inorganic sediment held in solution by water, by glacial action, seepage from rivers, and numerous other sources.

Oxygen acts on potash, soda, lime and magnesia and forms what are known as the alkali bases.

Oxygen unites with potassium and forms potash
Oxygen unites with sodium and forms soda
Oxygen unites with calcium and forms lime
Oxygen unites with magnesium and forms megnesia
but
Oxygen unites with silica and forms silicic acid
Oxygen unites with carbon and forms carbonic acid.
Oxygen unites with phosphorus and forms phosphoric acid.
Oxygen unites with sulphur and forms sulphuric acid

These acids called metallic or mineral acids have a great affinity for the alkali bases forming "salts," and this is where the whole trouble about alkali soils begins. These mineral or metallic acids attack the alkaline bases, with the following reslts:

Silicic acid forms silicate of potash, soda, lime and magnesia.
Sulphuric acid forms sulphate of potash, soda, lime and magnesia.
Carbonic acid forms carbonate of potash, soda, lime and magnesia.
Phosphoric acid forms phosphate of potash, soda, lime and magnesia.

It is the carbonate of soda, or what is commonly called sal-soda, which forms what is commonly termed "black alkali," and the sulphate of soda commonly called "glauber salt," which constitutes what is termed "white alkali." The numerous other salts are of course formed by combining the alkali bases and the mineral acids, but these are not so important in this connection.

When water is brought into the question the distribution of these salts is largely aided by the fact that the alkalis are extremely soluble in water. When these solutions are brought to the surface evaporation takes place and an accumulation of alkali salts becomes evident. As is commonly known these salts seriously affect vegetation if present in the soil in certain quantities, and are the enemies which we will have to fight in order to save our concrete structures.

Electric Welding for Shipbuilding

A special meeting of the Technical Commitee of Lloyd's Register of Shipping was held on the 25th ult. to consider the subject of the application of electric welding to shipbuilding to the extent of eliminating by this method the use of rivets for important structural connections. Electric welding has, of course, been employed for many years for ship repair work, but its use has been practically confined to parts of the structure not likely to be exposed to important stresses. In view of the importance of the subject to the shipbuilding industry of the world, the Committee of Lloyd's Register has recently carried out a series of carefully devised experiments to determine, as far as can be done by means of tests and analysis, the general trustworthiness of structural connections effected by electric welding and their capacity to stand the stresses to which they would be subjected in practice. After careful consideration the Technical Committee has decided to recommend to the General Committee for approval certain recommendations put forward by the chief ship surveyor as to the conditions on which, as a tentative measure, welding might be adopted instead of riveting in the construction of vessels intended for classification in Lloyd's Register Book.

Chemical Fire Extinguishers and Re-Charges

The Association of Chemical Fire Extinguisher Manufacturers have issued a cautionary notice drawing the attention of all users of chemical fire extinguishers to the fact that re-charges for these appliances should only be purchased from the actual manufacturers of the particular type of extinguisher which they have in use. It has come to the knowledge of this Association that certin people are offering to supply recharges for chemical fire extinguishers of any make, many of which are known to be defective and will not give the same efficiency in action as the proper re-fills supplied by the original makers of the extinguishers. It is also intimated that no firm belonging to the Association will accept any responsibility whatever for the inefficient results obtained from any chemical fire extinguisher of their make, unless it can be proved that the chemicals used therein were purchased from them direct, or through their authorized agents.

Mainly Constructional

East and West—From Coast to Coast

The construction of the lower pier at the Morrisburg, Ont., dock has been commenced. Mr. Wm. Birmingham, contractor, of Kingston, is in charge of the work.

The Hamilton, Ont., board of education has changed its decision as regards the plan of the 24-room school which it is proposed to erect in the east end of the city. A structure of two storeys is to be built, instead of one-storey, as previously suggested.

Building permits issued in Welland, Ont., for the month of August amount to a value of $15.760, as compared with $11,115 for the same month last year. The total for the first eight months of the year is $389,744, while for the corresponding period the value was $183,380.

The Flexner-Taylor Co. of Canada, Ltd., has been incorporated with a capital of $50,000, head office at Montreal. This firm is authorized to manufacture and deal in all kinds of asphalt and asphaltic preparations, asbestos, cement, and various other building, paving and roofing materials.

The Northern Construction Co. has been awarded the contract for the construction of the Pacific Great Eastern Ry. 52-mile extension, north of Clinton. The tender was $419,000, on a unit basis, 5½ per cent. commission. There will be no commission on excess of estimate of cost. The contractors are to furnish steam shovels, donkey locomotives, dump cars and all rolling stock and construction equipment free. They will receive 25 per cent. on the saving on the unit prices. It had been reported that Cotton Bros. of Vancouver, whose bid was $318,000, had received the contract, but the statement is now made that this firm has been disqualified on account of its inability to satisfy the government's engineers that it is in a position to carry out the work.

The erection of the Hunter Street bridge is under discussion by the Peterboro city council. A deputation from the council recently visited Toronto to inspect some of the structures erected there. It is understood that the Canadian Leonard Construction Co., who have built the Quaker Oats factory in Peterboro and have a complete plant in the city, will tender on the construction of the new bridge.

It is reported that the Spanish government has decided to investigate a scheme for a tunnel under the Straits of Gibraltar, connecting Spain with Africa, and will have an engineer go into the proposition. It is believed that it could be completed within five years. The scheme is not a new one, having been suggested as long ago as 1898, by M. Berlier, at a meeting of the Society of Civil Engineers in France, but it was then considered impracticable. However, it has been once more revived by M. Henri Bressler, who lately read a paper on the subject before the same society.

On Aug. 28, 29, 30, the thirteenth annual convention of the Union of Nova Scotia Municipalities was held at Liverpool, N.S. The good roads problem was the chief topic of discussion, and it was proposed that superintendents in the various municipalities attend a course in road making at the technical college during the winter. In order to make this practicable, it is suggested that a course in roadmaking be added to the curriculum of the Agricultural College at Truro, N.S., the matter having been referred to Prof. Cumming, secretary for the college, and Mr. W. G. Clarke, chairman of the provincial highway board. Mr. Clarke assured the convention that the Provincial Highway Board has had the matter under consideration and has taken up with the government the advisability of instituting such a department in connection with the college.

The big Bucyrus shovel employed by the Hydro-electric Power Commission of Ontario in the excavation of the canal from the Chippawa Creek to Queenston Heights, has been put out of commission by an avalanche of clay which came down upon it from the face of the cutting. The slide was from the left bank of the cutting, and the big machine was driven backward about 30 feet, broken loose, and partly dismounted from the truck on which it travels. Its backward movement saved it from being buried and more seriously damaged. Several workmen had a very narrow escape. The boom of the shovel was torn off, thrown to one side and badly fractured in two places. The cutting is about 90 feet deep, and the stratum exposed is mostly of quicksand character. Above this is a great bed of red clay, and at the surface several feet of top soil. The digging of the big shovel out of the earth surrounding it is a difficult task. A revolving locomotive crane was brought up from the forebay works, near Queenston, to assist in the excavation.

Personal

Lieut. F. C. Clemesha, the well-known Regina architect, has been listed among the wounded during the recent fighting in France. Lieut. Clemesha left Regina in May, 1915, with a draft of the 46th Battalion. Prior to enlisting he was senior partner of the firm of Clemesha & Portnal, architects, and designed many important buildings. When competitive plans were called for the Winnipeg city hall, his were awarded the prize.

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Guard St. Lawrence Power Rights

COMPARATIVELY little headway appears to have been made toward a decision in the matter of the application of the St. Lawrence Power Co. for permission to construct a deflecting weir in the St. Lawrence River at the Long Sault. The Canadian Government takes the stand that it is a matter for consideration by the two countries involved and that it is without the jurisdiction of the International Waterways Commission. On this basis it is argued that the proposed works would be in direct contravention of existing treaties. The feeling is general in Canada that the St. Lawrence Power Company, which is a subsidiary of the American Aluminum Company, is making the plea of war exigency to secure concessions which would not be considered under normal conditions. No doubt the suggestion that the consent of the Canadian Government would be forthcoming on condition that the work be removed within a year after the ending of the war is born of this thought. Considering that the cost of the weir is only estimated at $125,000 as compared with assets of this company which would run into possibly one thousand times this amount, the scrapping of the work would cause the company no financial inconvenience. The argument that the whole thing is just a "power grabbing" scheme seems to be further borne out by the fact that this company has large blocks of undeveloped power at different points in the United States; for example, on the Tennessee River, where it is estimated some 400,000 horse-power is running to waste.

However, it seems quite unnecessary to discuss at the present time what the ultimate aim of this power company may be. A great deal is at stake in the matter of power development; comparatively nothing, in the matter of dollars and cents. If the St. Lawrence Power Co. does not see its way to make a temporary investment of $125,000, why should not the U. S. government do so. Indeed, if the Canadian government could be satisfied that the request is made in good faith, it is quite conceivable that Canadians are patriotic enough to donate to this company the matter of $125,000, so that the prosecution of the war may not be interfered with. If, however, the attitude of the St. Lawrence Power Co., or the attitude of the U.S. government is that this weir should remain a permanent fixture, irrespective of the effect it may prove to have on conditions of flow in the St. Lawrence River, there is no question whatever that the matter must be fought to a finish by Canada. As between our perpetual rights on the St. Lawrence and this bagatelle expenditure, there is no comparison.

A Frequent Cause of Explosion

MANY of our serious fires cause grave doubt as to whether or not we fully realize the great danger of permitting accumulation of refuse, especially dust of various kinds. Large pieces of wood do not ignite quickly. If we want to kindle a fire, we reduce a large stick to shavings. If these shavings were ground to a powder and spread out in a thin layer, they would be more easily lighted and would burn very quickly. If these particles were very fine and were scattered about so that they were well mixed with the air, it would not require a match to light them. A very small electric or friction spark might cause this dust laden air to take fire and burn so rapidly that it would cause an explosion. The main difference between the halting combustion of a pile of damp wood or leaves, and the explosion which sends a large projectile on its way, is that the wood or leaves burn slowly, giving time for the gaseous products of combustion to dissipate themselves without crowding or violent expansion, while explosive powder burns with such extreme rapidity that gas is created faster than it can find vent. The rapidity of burning, other things being equal, is largely a question of exposed surface. Substances which at the temperature of ordinary flame ignite with difficulty or not at all, will burn quickly and even explode if we divide them into small particles to afford a sufficiently large exposed surface.

The architect can assist in making fires or explosions impossible by proper planning of factories and other industrial buildings, but those employed in the handling or storage of all kinds of finely powdered material must exercise common sense and caution. Many varieties of finely divided matter will burn, under favorable conditions with a speed that will convert combustion into explosion; for example, dust from grain, sugar, paper, cotton, leather, wood, cork, and a host of other materials. No material of any kind can be handled or worked without giving off a certain proportion as dust. We cannot handle or manufacture without employing mechanical means that may produce friction and electricity. Sparks are probable and if conditions are favorable the dust particles in the air will ignite and the possibility of a dangerous explosion is at hand.

Dust, with spark or flame, is eternally plotting to destroy valuable property, food stuffs, and even lives. Only by great and constant vigilance can this enemy be defeated.

The Cost-Plus System

A CONTRACT with a fixed price is no longer feasible owing to the unsettled condition of the market for materials and difficulties and sudden changes in the building labor world. If the present tendencies continue, it will be within the bounds of possibility to see, in the future, all building operations of any magnitude carried on by organizations furnishing from a single source every sort of technical service, as well as all material and labour. In fact, organizations of this kind are already in successful operation.

In the preparation of plans, the closest co-operation between the architect, owner and contractor, is necessary. The former should consult with the latter as to materials and prices, and the owner should also be advised fully during the preparation of the plans and specifications so that the cost of construction may be kept within the limits of the owner's desires. This is particularly necessary under the cost-plus system, as all risk caused by fluctuation of prices will be shifted from the shoulders of the contractor to the owner, and financial embarrassment to the owner may easily follow from excessive cost.

The cost plus system will, to a certain extent, eliminate from the building game the spirit of trading and business strategy, which will be a big improvement on the old fixed price contract system. Under a fixed price contract there was often a feeling between the owner and contractor that one might take advantage of the other when the opportunity offered.

It would appear that the owner, under the cost plus system, would be assured a satisfactory job at a fair price, a price which will allow the contractor a fixed, fair profit. This should undoubtedly tend to satisfaction to all concerned, eliminating the friction which, unfortunately, too often exists at the completion of the job.

Building During the War

THE curtailment of building during the war is not a saving but an expense because, through lack of facilities, the cost of everything is increased, since buildings are tools of industry, necessary for the production of all other tools of industry in addition to the necessities of life, food, clothing and shelter.

Buildings are a source of production; they create rather than exhaust capital. There is no use to which raw materials can be put that will create more. Buildings are a permanent form of wealth and produce more wealth. Money tide up in idle land is dead; put a building on it and it becomes alive and an earning power. By curtailing the consumption of food, clothing or luxuries, we add to the wealth of the country; by curtailing building we lose. If expansion to your plant is necessary, don't postpone it until after the war in anticipation of lower cost. We must be prepared for the commercial campaign that will, logically, follow the war. Lord Roberts preached preparedness for years, but very little attention was paid to his efforts. What did this lack of preparation cost us in British blood and in length of duration of the war?

There is little doubt that America will be called upon to supply industrial necessities to Europe. The warring nations in Europe have more or less exhausted themselves in the titanic struggle and they will be, to a great extent, dependent on this country. If we are not prepared to compete at the very outset, our big opportunity is gone. If the essential industries are hampered by lack of space now, what will be their chance of engaging in competition with organizations that have been far-seeing enough to prepare for the extra load likely to be placed upon them? Build now and be ready to produce at the first call.

There seems to be little prospect of a reduction in building cost for many years after the war; in fact, costs may be even higher than they are to-day. Costs are based primarily on cost of labor, and it is a well known fact that when wages have been raised, it is a most difficult thing to reduce them to the old standard.

Those interested in construction generally begin to realize that the days of low cost—if they ever come again—are in the distant future. The war has caused a huge increase in all building materials. The decrease in men through losses in the war, the rebuilding of devastated France and Belgium, and the consequent demand for labor, means that under the law of supply and demand, labor is going to be high for a long time to come. Material costs will also remain high for the same reason.

It would appear that an unprecedented era of general industrial activity is in prospect for Canada at the conclusion of the war, if Canada is in a position to deliver. Don't let us fall down—don't let Canada fall down. Let us be in a position to complete with our neighbors and allies as well as with our enemies.

Electric Welding Stands the Test

AT a meeting of the General Committee of Lloyd's Register, the recommendations of the Technical Committee, following the experimental work of the Chief Ship Surveyor, that electric welding should under certain conditions replace riveting in ship construction were confirmed.

The rules have been devised on the results of experiments on electrically welded joints, which included the determination of the ultimate strength of such joints and of the elastic properties, capacity to withstand alternating tensile and compressive stresses, such as are experienced by ships, and also chemical and microscopic analysis to determine whether a sound junction was effected between the original and added metal. The results of the test may be considered on the whole to be very satisfactory.

The regulations are divided into two parts; the first dealing with the system of welding and workmanship, and the second with details of construction. Under the first heading attention is drawn to the necessity for ensuring that the electrodes used are of uniform and reliable quality, and that only skilled workmen are employed under supervisors of proved ability. When it is remembered that most of the failures and disappointments which have occurred in the use of electric welding have been due to a neglect of these elementary precautions, the desirability of these requirements will be apparent. The specification of the details of construction provide that all butt and edge connections must be lapped or strapped, the experience derived from the experiments having shown the greater suitability of these forms of joint. A complete fillet of welding is required to be fitted on each edge of the butts and landings of the shell, inner bottom and decks and the butts and edges of bulkhead plating. In the case of angle connections, such as of frames to shell, beams to deck and bulkhead stiffeners to plating a complete run of light welding is required at the heel of the bar intermittent or tack welding at the toe.

The rules are necessarily of a tentative nature, and will, no doubt, be modified from time to time, in the light of the experience which will be available after a few welded ships have been in service. They have been issued at the present time primarily with a view to giving builders some guidance as to the lines on which they should proceed, but the Committee will, as usual, be pleased to consider any alternative proposals that may be placed before them.—The Engineer.

Ethical Standard for Engineers

THE Cleveland Engineering Society has appointed a committee to make a thorough study of codes of professional ethics prepared by lawyers, doctors, architects, contractors, engineers, etc. It is the intention of the Society to prepare a booklet giving all material of interest to the members, in concise form, David Gaehr chairman of the committee in an address stated that obviously, a logical and fair classification of men engaged in engineering should be made at once, approved by the national and local societies and brought home to the public. Those who have been styling themselves engineers without being eligible to membership in the profession should be forced to discontinue the use of the title.

Eliminate Engineering Parasites.

If those able to produce evidence entitling them to be called engineers will band together in a way that should make all professional men feel at home, then the craftsman, tradesman and engineer parasite may be eliminated from the field of professional engineering. Then and then only can we look forward to a new era for the engineer, an era in which he will pursue a dignified calling, the primary object of which will be service to humanity and the secondary object, a livelihood. By co-operation through their national society architects have accomplished remarkable results in the way of gaining improved public esteem and bettered financial returns. Physicians and lawyers have taken advanced stands and controlled their interests. None of these professions would countenance many of the conditions under which the engineering labors heavily.

We would urge that members of the Cleveland Engineering Society agree on definite standards to which a man must conform before he may call himself an engineer. Such standards should emphasize not only technical qualifications but also, and as strongly, those of character. If a man would be called an engineer and be a member of the Cleveland Engineering Society agree on definite standards to which a man must conform before he may call himself an engineer. Such standards should emphasize not only technical qualifications but also, and as strongly, those of character. If a man would be called an engineer and be a member of the Cleveland Engineering Society he should be bound in honor by the standards of ethics adopted by our society, irrespective of his business relations or employment. Inasmuch as the enforcement of a code of ethics pertains especially to the local societies, we should bring the subject to their attention, requesting their co-operation in a nation-wide endeavor to raise the standing and standards of the profession.

Marshal Forces Not to Attack But to Resist.

The next step is to eliminate from within those things which undermine self-respect. For instance, certain public and commercial enterprises have been quick to recognize and exploit the vulnerable side of engineers, so that methods of obtaining business which at one time may have brought temporary gain for a few have developed to such magnitude as to make it increasingly hard for honorable men to apply their talent in the practice of their profession in exchange for reasonable compensation. We must marshal our forces, not to attack, but to resist, in concert, the common practice of exploiting engineers, as well as to stop once for all the reproachable activities of some engineers whereby other members of the profession and the public fail to receive a square deal. It is plainly wrong from a business standpoint for any high-grade man to render services gratuitously except in emergencies or for obviously charitable reasons. Charity extended in a business way is a farce, and nothing has undermined the standing of the profession more than the placing of services free of charge at the disposal of prospective clients. Everyone knows that only a small percentage of proposal work ripens into contracts. Hence, for all "charity" work the wrong man pays, and in the end the public suffers injustice.

Financial Burden on Client or Contractor.

Although vested with great responsibility in large enterprises, the engineer leaves to the client or contractor the financial burden of failure due to his faulty specifications or design. This is typically expressed in the so-called "grandfather clause" providing that if specifications and drawings contain any omissions the contractor shall make them good without charge.

A committee on ethics does not lack standards, but its work is to bring them home to individuals in instructive and forceful manner. "If ye know these things, blessed are ye if ye do them," must be reinforced by the penalty provided for infractions of stipulated restrictions and obligations.

A valuable rust-preventive coating for general priming or finishing work may be prepared from sublimed blue lead. The use of two parts of blue lead and one part of linseed oil containing about 5 per cent. of turpentine drier makes a paint of the right consistency. When this paint is used for top-coat work in marine exposures—battleship gray—the addition of 1 per cent. of carbon black to the blue lead aids in the maintenance of the color. The rust preventive value of this pigment is due to the high percentage of lead oxide (litharge).

The best preventive of loss in coal storage is to inspect the pile regularly. If the temperature reaches 150 deg. Fah. the pile should be carefully watched, and if the temperature rises to 175 deg. or 180 deg. Fah. the coal should be removed as promptly as possible. The coal should be thoroughly cooled before being replaced in storage.

Any System is Better Than the Lump-Sum Bid

The Ideal Contract Stimulates the Contractor to Do His Best Work and in the Shortest Time

THE volume of work and the speed demanded by the allied governments in their emergency construction contracts has made practically impossible the usual lump sum bid of the contractor. There have been various other forms of tender in use both in the United States and Canada, but in the majority of cases the responsibility and risks fall on the shoulders of the contractor. Mr. Henry D. Hammond, in the Engineering News-Records, points out the advantages and the efficiency stimulating features of the system becoming adopted in the United States and it appears that it could be used to advantage in Canada.

Based on the fact that anyone who takes a construction contract will carry it out to the best of his ability if the possibility of his obtaining further work and the size of the reward which he can demand for it depend on his establishing a reputation for doing work that is satisfactory to his client at the lowest possible cost, a new way of doing business between private owners and contractors has sprung up in this country. The superiority of this method, which discards the lump-sum and unit-price forms of contract in favor of the percentage form, has long been demonstrated abroad. It owes its superiority, however, to the fact that its workings differ as widely from those of the percentage contract, as commonly understood, and as applied at present on Government work, as they differ from those of the lump-sum or unit-price contract system.

The new system, on which has been built the business of many of the largest and most successful general contracting firms of this country, promotes efficiency because the contractor finds it possible to obtain more business directly in proportion to his reputation for doing work quickly and efficiently. To make the system effective the owner must show complete confidence in the ability and intention of the contractor to deliver the structure which the owner desires at the lowest cost. The owner has this confidence both because the contractor has shown such ability on previous work, either for the same owner of for others to whom the owner can refer, and because the latter knows that should the contractor fail in point of cost, quality or time in meeting the requirements of the work the contractor would lose his reputation and be unable to obtain further business.

Owner Assumes The Risks.

As the system employes the percentage or fee form of contract, the owner assumes the risks which are thrown on the contractor by the lump-sum form of agreement, and the latter is left free to devote his entire energy to completing the work in the most efficient manner. As the contractor is able to capitalize efficient work by getting a larger volume of business and charging a higher rate of return if his interest becomes one with that of the owner and the engineer in producing a structure which completely satisfies the requirements laid down in the contract. As a result, the system eliminates the expense of double control of the work and duplicate checking of all the contractor's operations. Moreover, it eliminates the large risk which the contractor assumes under a lump-sum contract in the interpretation placed on the specifications by the owner's engineer. For no matter what this interpretation may be, the owner is paying for the work done and the contractor is devoting his undivided attention to delivering it as directed. It may be said, then, that three things differentiate the system from percentage contracts as generally understood in this country: First, the attention of the owner to select the contractor on the basis of past efficiency, and to leave to him the carrying out of the work just as its design is left to the engineer. Second, this can be safely done in spite of the percentage form of contract, because, should the contractor fail in point of cost, time or quality to meet the requirements of the work, he would injure his reputation, and diminish his chances of obtaining future business and his ability to secure higher returns. Third, the system stimulates the distribution of the returns earned by the contractor through bonuses and increased wages among the working force, in the effort to build up the most efficient possible organization.

It is because the incentive of private profit which is the distinctive feature of the lump sum contract is absent in the percentage contract that the latter form of agreement is justly considered a dangerous one, which if persisted in will destroy the morale of the construction force, prevent the development of new methods and, finally, result in stagnation.

Employees Benefit by Plan.

The critics of the system, which is gaining favor among private owners and contractors, however, make the mistake of assuming that there can be no motive for the improvement of methods or efficiency except the one of financial advantage to the proprietors of the construction firm. As a matter of fact, this motive, which is admittedly supplied by the lump sum contract system of competitive bidding, leaves much to be desired. It is partial in operation, impelling to action only the owners of the contracting enterprise. It cannot be expanded to the working force except through voluntary action on the part of these owners, and is rarely in practice so extended. The new contract system, however, supplies the motive of personal gain all along the line from the proprietors to the last laborer, through high rates of pay to efficient crews and bonuses for keeping the work within the estimates of time and cost.

This may seem a startling claim for any form of contract under which the owner of the structure being built pays all the bills and in addition gives the contractor an additional fee, whether fixed or a percentage of the total cost, for his experience and services. The entire contradiction, however, vanishes under scrutiny of the system in operation.

The contractor has to sell, besides the labor and materials which go into his work and the use of his equipment and capital, a definite, tangible thing. It is difficult to describe; but it may be outlined as his experience and ability and his reputation for using labor and materials to produce good work at the lowest attainable cost. Under the lump sum form of contract, there is no direct recognition of the fact that this thing is bought or sold. The contractor must take his chances of being compensated for it, and he receives payment for it only when he succeeds in accomplishing the work specific under the contract for less than he has led the owner to believe that it would cost. This compensation is known as profit. It extends only to the owners of the contracting enterprise. It is understood that the contractor is entitled to it, but from it must be deducted all expenses due to the risks involved in the work. These include damage and delay to the work from natural causes, changes of mind on the part of the owner, and expenses due to a lack of exact undestanding between the contractor and the engineer—a thing bound to occur in some degree on every contract. There is always present the temptation to add to the contractor's profit by lowering the quality of the work performed, with no check upon it except the vigilance of the owner and his engineer. The exercise of this vigilance necessarily produces constant friction.

The percentage and fee forms of contract recognize this thing which the contractor has to sell, and fix a compensation for it. In so doing, they properly transfer the normal construction risk from the contractor to the owner. They also remove the cause of friction between the engineer and the contractor by making it impossible for the latter to affect the total compensation for his services by reducing the quality of the work. At the same time these forms of contract make it impossible for the contractor to affect the amount of compensation for his services by improving his methods and increasing his efficiency, and therefore they are justly considered failures.

System Improved in This Country.

The actual form of contract used in this country under the new system usually includes time and cost penalty and bonus provisions which make it possible for the contractor to affect directly his compensation on the individual job. This, however, is an improvement which appears to have been grafted on the original system as commonly employed in Europe, where the experience, ability and reputation of the contracting firm are evaluated at so much on each new contract it undertakes, and paid for as such regardless of the cost of the work. In operation this system makes it inevitable that the contractor's efforts will have a profound effect on his reward. If the contractor does not maintain his reputation for doing good work engineers will not engage him. Thus he is put out of business and his returns cease, as he has nothing left to sell. If he lacks experience it is impossible for him to get work except by associating himself for a time with contractors who already have reputations. In practice this has not prevented a sufficient number of new firms from being established, and all public engineers have at one time or another wished heartily that there were some way of keeping out of the contracting field men wholly without experience. If the contractor does not possess ability to carry out work efficiently, if he does not develop new methods and does not improve the quality of his service, he cannot obtain an increasing price for it on succeeding jobs; and if he actually recedes in ability and suffers in reputation, he must expect a smaller return, and in a short time will be unable to obtain work.

In order to do his work better than the next man, and obtain an increasing volume of it on which to realize increasing returns, the contractor employs the best men that he can find. They contribute to his business by lowering the cost of his work, and he is able to pay them more by demonstrating to each succeeding owner that they are worth it. In this way the increasing rewards which can be won by the progressive contractor under the system are distributed all down the line instead of being concentrated in the hands of only those persons who have invested capital in the business. For a superintendent who has done a particular piece of work for 10 per cent. less than the original estimate, the contractor can easily ask and secure a large increase on the next job. In the same way, if he has an efficient crew of riggers or pipe fitters, the contractor can easily show his client from the cost sheets of past work that these men are worth more than prevailing rates. Not only is it possible for the contractor to do this, but it is the most natural thing for him to do under the system, because it is to his immediate interest to build up and hold the best organization that he can obtain.

Competitive Bidding Unsatisfactory.

Under the system of competitive bidding contracting is a hand to mouth game. There is nothing to prevent persons without experience or organization, but who can secure financial backing, from stepping in and taking work from reputable contractors at figures that are too low to compensate for the work performed. As a matter of fact, just this happens every time some new class of construction gains the reputation of being profitable. Where it becomes known that large returns have been made in the past, bonding companies and banks are willing to back anyone entering the field A few years ago this condition developed on state highway work throughout the country, and it was not equalized until the public and the reputable contractors had suffered severely and many would-be contractors with their backers had sustained heavy losses.

Under the new system the contractor is assured of work in normal times so long as he maintains his reputation. The business-getting methods employed are simple and eliminate all motives for disguising costs. The contractor estimates the work on the information which the engineer has available, just as in competitive bidding, and tells the owner the limits within which the contsruction cost, including overhead, will fall under his management, and sets a price, either a lump sum or a percentage of the cost of the work, on his own experience and ability to carry out the work.

Where the value to the owner of the completed structure is great, as is frequently the case, and a saving of time will warrant additional construction expense, this factor is considered in estimating the work.

It will thus be seen that the contractor's success under this system, both in procuring work and in building up the rate of return to himself and his organization, depends absolutely on his ability. If a contractor cannot progress, cannot build up and strengthen his organization, he cannot hope to expand his business under this system. If he cannot hold his own with the field, it will be impossible for him even to remain in business.

There are many legal difficulties in the way of adopting such a system on public work, besides the great political difficulty of obtaining as good management by Government bodies which supervise construction work as there is by private enterprises which require new building. At the present time, however, the Government of the United States has swept away legal difficulties, has neutralized to a considerable extent political difficulties, and has awarded not only construction work, but contracts for the production of all sorts of materials and implements of war, on a percentage basis.

It would be an easy matter to convert this percentage system to the one outlined here. The Government has already set up machinery for evaluating the reputation and ability of construction contractors, munition makers and others who furnish the Government with supplies. It could well go a step further, use this machinery in measuring the performance of these contractors on the work which they have, award future work on the basis of this information, discard the present double-control system and trust the contractor to deliver the work. The Gordian knot of illegality has already been cut, and there is no reason why we should not go beyond the percentage system and institute really efficient methods.

Would Stimulate Production.

Not only would the system stimulate production efficiency on all Government contracts, but it would throw a new light on all questions of difference between capital and labor over the division of the rewards. For there would be no profits to the owners which could possibly be increased or decreased at the expense of labor or by manipulation. The owners and managers would be paid for their services, skill and resources a just figure which had been publicly fixed after considering all the facts, and which would be subject to variation only as they proved themselves more or less efficient than they had originally been judged to be. Moreover, it would be possible to extend the increased rewards for efficiency to the working force through action of the management, with the sanction of the Government, which would be warranted by definite facts and figures of production. The management would have a direct incentive to pursue this course, since only in this way could it build up a more efficient force, decrease its unit cost, increase its output and secure higher returns. And the Government, confident that it controlled the contractors through its means of measuring their efficiency, could reduce its heavy expenditures under the present harassing and unproductive system of supervision and control.

Some improvement over the present methods of contracting followed by the Government must come, as the demand for it is practically universal. Everyone will admit that the system of competitive bidding cannot be relied upon to satisfy the needs of the present crisis, while the percentage and fee forms of contract, which give the contractor no immediate incentive to better and more economical work, are being assailed and have already been revoked in important cases. It would seem that the system which has proved so successful in Europe; which has established itself firmly after some years of trial wherever it can be legally used in this country; which furnishes an incentive to efficiency not only to the owners and managers but to the entire working force; which substitutes powerful motives to co-operation for the divergent motives which lead to constant friction under other contract forms; and which tends to stabilize business and increase production, should receive most serious consideration.

Practical Points in the Design and Construction of Partitions

By H. L. Barraclough*

LIKE many other things, the war has brought partitions into an almost endless number of uses, one of which has been for the building of huts and houses. Though this may be new to some, the writer has been concerned in the building of schools and sanitoriums with plaster slabs, cement rendered outside, and those places stand to-day as when erected.

Simple, as it may seem, the erection of partition slabs, as experience has proved, should be entrusted only to the hands of men used to this particular class of work. A badly built-up job is sure to develop cracks in unthought-of places, the blame very often being fixed on the manufacturer of the particular partition slabs. This long-suffering individual very often has little means of replying to the criticisms, where the slabs alone are supplied by him.

There are several kinds of partition slabs manufactured and on the markets—breeze, pumice, plaster and clay—each of which has its special claims.

Plaster, until recently, has been the most common in use, and has many advantages over breeze slabs. Solid plaster slabs are light, easily fixed, with little or no waste in erection. When up, they form a solid wall, hygienic in all ways, as every possible lodgment for dirt and vermin is effectually closed after the walls have been plastered out, and are fire and sound-resisting, provided the work has been executed by skilled labor, which goes largely to ease the question of after-cracks.

My opinion is that hollow plaster slabs, although lighter, have some objectionable features, the compressional strength of the slab having been somewhat destroyed through the apertures; and further, if spiking is resorted to for fixing, very often the spikes crack the slabs when being driven in, and generally weaken the whole wall.

In fixing plaster partition slabs, it is essential that the suction should be destroyed by applying a thin cement wash, and that they should be well bedded in plaster in preference to spiking.

It is preferable that all slabs, used for partition work, should be tongued and grooved horizontally and vertically, and, in fixing, the grooves should be placed upwards and the joints broken, as in brick work, and the vertical joints carefully grouted in with plaster, both where they join up to the door frames or brick walls, and where they butt against each other. Where a slab has to be cut it is advisable to form a groove by scooping a piece out.

Plaster slabs have been successfully used for external works fixed on wood framings and faced with tiles, but this is an expensive form of work, and if not carried out by experienced labor the tiles are liable to come off.

Seven years ago, 2-in. plaster slabs were used for internal and external walls of a school in Northumberland. The slabs were fixed to wood framing on outside, rendered over surface with cement, mortar floated to an even surface and rough cast with a mixture of slag and pea gravel, 1-in. internal slabs nailed to framing floated and skimmed with washed haired lime and putty, and finished with putty and plaster throughout, a dado of 3 ft. 6 in. being formed with portland cement back, and finished with Keene's cement face, trowelled smooth. It has proved a very satisfactory construction as well as cheap.

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* Extracts from paper before Concrete Institute, London, Eng.

A well-known firm has recently introduced a plaster slab with a special face to receive cement rendering for external work, and they claim that it will withstand the weather for 20 years without being re-rendered. These have been used for external works on several jobs in the Midlands, and would appear to be eminently suitable for a cheap-system cottage or bungalow building. This system could be used in conjunction with light reinforced concrete piers and beams or wood framing, and has the advantage of being a very rapid construction. Doors and windows can practically be fixed in any position, as the openings can easily be cut, after the wall is up, without much danger of damaging other parts.

The foundation need only be 9 in. depth of good concrete under the wall, weathered on the outside doing away with the necessity of any damp course.

The pumice slab is a very light form of construction, convenient to handle, and is manufactured from pumice and volcanic sand (imported from Italy) mixed with portland cement. These slabs form a rigid construction when up. Nails can readily be driven into them and take a good hold, doing away with the necessity of plugging for fixing skirtings or picture rails.

The hollow terra cotta partition tile is well known to many, and can be obtained in different sizes from several firms, and has the advtange of being easily handled. It can be obtained with a keyed or smooth face, and is being used just now extensively for exterior work. It is easily built up, the horizontal joints being bedded with cement, and the vertical joints grouted up, and seems to be quite effective in withstanding the weather but it has only come into prominent use for this purpose recently, owing to the present shortage of other materials, and it remains to be proved what effect time will have on it. I am however, strongly of the opinion that there are several points in its favor for this purpose, being cheaper than a brick wall of the same thickness, resists the damp better and insures a more even temperature, but does not lend itself to nailing. Where it is necessary to fix skirtings and rails, provision should be made for same at the time of erection by carefully inserting plugs in the joints. Should this not be done at the time of erection, and it is found necessary to fix electric fittings or hook rails, the joints should be cut out, and a plug built in, as any attempt to drive a nail into the tile is generally a failure, besides being liable to break the face of the whole tile.

Those of us who have had to do with partitions know only too well that they mostly have the annoying habit of showing cracks which more often than not go right through. These cracks may develop from either of the following causes:

The cracks generally occur just under the ceiling or near the walls and door frames, or at top corners of door frames. The cracks at the tops or by the walls may be caused by variation of temperature, causing expansion or contraction, or through the supports deflecting or settling. Cracks also are generally to be found on top stories of buildings with large flat roofs, owing to the expansion of the flat as well as the partition, and up to the present I have not seen any successful method of stopping this occurring with a built-up partition, for even when cut and carefully filled in, the cracks will readily appear again.

The cracks on doors are particularly noticeable when the jambs project a few inches above the frame, and this is caused by the wood frame swelling, through absorbing the moisture from the partition whilst it is being erected. These can generally be stopped up successfully if cut out and filled in, after the partition has had time to dry out, and will not appear again, provided the door frames are fixed rigidly enough to prevent the partition from being shaken when the door is shut quickly. The best remedy, however, is to prevent this by stopping the door jambs off flush and carrying the partition over in one slab. This method is now recognized by most practical fixers as the best, and, with few exceptions, is carried out wherever possible.

The position of a partition is too often left to be settled after the floor and beams are all in, and then it is placed anywhere, whether the weight is supported by a main beam or only by the floor, away more often than not gets placed on the floor, away from the main beam, which may only be calculated to carry a load of 100 lb. per sq. ft., whereas many 3-in. partitions, when plastered both sides, weigh 18 lb. per square foot, and 10 ft. is quite an ordinary height for such a partition, therefore 1 ft. run would weigh 180 lbs. The heaviest articles of furniture in domestic buildings are generally placed against the partition, and in an office it is quite an ordinary occurrence to find a heavy safe one side and a tier of shelves filled with books and papers on the other. Taking the total weight of the safe at 15 cwt. placed in the centre of the bearing, and the bookcase at 2 cwt. per foot run, we find, if a 3-in. partition, 12 ft. wide by 10 ft. high, happens to be placed on the floor, we get the following load per square foot in that particular place:

3-in. partition = 18 lbs per sq ft. x 12 ft wide x 10 ft high = a distributed load of	2,160 lbs
1 safe = a distributed load of 30 cwt = ...	3,360 lbs
1 tier of shelves 10 ft. wide at 2 cwt. per ft. run = 20 cwt. = ...	2,240 lbs
Giving a total load of	7,760 lbs

Taking the width of floor occupied as 3 ft x 12 ft = 36 sq ft

Therefore, 7,760 lb. divided by 36 equals 215.5 lb. per square foot on this particular portion of the floor, which is more than double what the floor and main beams were calculated to carry, and except for the large safety factor required by the authorities there would be more than mere cracks appearing. The writer is strongly of the opinion that the position of all partitions wherever possible should be settled at the time of planning, and proper beams arranged to carry them, and when this cannot be done it is advisable wherever possible to have partitions cast in situ and reinforced with small steel rods, forming a beam from wall to wall. This method has been carried out by me and has always proved most satisfactory, and helps very considerably to tie the wall and distribute its load more evenly, and costs little more than a built-up partition.

Dominion Rubber System's New Home for Employees

THE illustration shows the new Dalhousie Hall erected by the Dominion Rubber System as a home for women and girls employed at the Maple Leaf Rubber Factory, Port Dalhousie, Ontario.

The entrance to Dalhousie Hall on Main St. is of carved stone and is ornamented with tasteful electric light standards, the main doorway being slightly above the level of the street. Through a pair of French doors of solid oak, the visitor enters a lobby, where a short stairway leads to the level of the main floor, six or eight feet above the street. Another pair of doors leads thence into the main hallway, and to the large reception room extending across the full width of the building and divided into two sections by the hallway. The section on the right is used as a living room, and that on the left is a music room. Both are furnished with furniture including tables, chairs, pianola, etc., which, with the hangings and pictures, show careful selection as to harmony of color and design. The main hall is carried through the centre of the building to the entrance of the dining room, the vista from the entrance extending through the glass doors of the dining room to a large fire-place immediately opposite the entrance.

French oaken doors, of the type already referred to, are a notable feature of the designing throughout the building; these doors separate main hall from dining room, and all stair halls from main halls on each floor, thus providing plenty of light and at the same time effectively separating each apartment. The woodwork throughout is of hardwood, satin finish.

Reverting again to the main hall, this is flanked on the left with another small reception room, an ample sized cloakroom, and, further in rear adjoining the dining room, the office of the Social Secretary. The dining room with its polished maple floor, large brick fireplace extending to the beam ceiling, and windows in pairs on east and west sides, is a most attractive room. It is furnished with twelve circular tables, having a maximum seating capacity, without crowding, for 72 persons.

In the rear of the dining room, and extending across the width of the building, is a most thoroughly equipped kitchen, with every facility for rapid service of appetizing meals. An unusually large electric range occupies a central position. A large refrigerator on the main floor is supplemented by a cold storage compartment in the basement.

The basement floor, which is sufficiently elevated to be very well lighted, includes a recreation room appropriately decorated, suitable for the entertainment of a large number of guests. Furniture includes tables, chairs, piano, etc. A laundry, with several sets of stationary tubs, ironing boards with electric irons, drying closets, etc., is also included on this floor. The heating equipment for the building,—a Spencer steam boiler system—fuel storage, complete water-works system comprising electrically driven pumps and storage tanks for hard and soft water, are also included in the basement equipment.

The first and second floors are used for completely furnished bedrooms. The furniture for these rooms was specially designed, principally in ivory enamel finsh. Draperies and rugs for these rooms are in a variety of tones to harmonize with the furniture.

At the rear of the building, balconies on each floor give views of Lake Ontario, which is but a couple of hundred yards distant. A splendid bathing beach is in close proximity and Mr. Rieder has kindly permitted the erection of suitable buildings on his property, fronting on the lake shore above the beach, for use of residents of Dalhousie Hall.

Much credit is due to Miss D. Rieder, Social Secretary, for the excellent taste in which the building is furnished throughout, and for the admirable manner in which the home is conducted.

The enterprise is one which places the Dominion Rubber System as a leader in movements having for

Dalhousie Hall, Port Dalhousie, Ontario

their object the welfare of employees. It is in keeping with the progressive policy taken by the company, under the presidency of Mr. Rieder, and heretofore evidenced by a continuity of interest in the welfare of all Dominion Rubber System employees.

Credit must be also given to Mr. P. Y. Smiley, footwear factory manager, for the zeal and interest he has manifested in this project. He has ably supported Mr. Rieder in providing a home that is easily the best and most complete of its kind in Canada.

Sewage Disposal at Maidstone

By T. F. Bunting*

IN 1888 the sewage of Maidstone was conveyed by gravitation to works 1 mile above the locks at Allington and, after screening and precipitation by lime, the effluent was diluted with 50 per cent. of river water and then discharged into the tidal portion of the Medway a few yards below the locks. Needless to say, this method was unsatisfactory, and that, beyond keeping the sludge out of the river, very little purification of the effluent was obtained; and during flood tide the proportion of effluent to river water in the neighborhood of the locks gave rise to numerous complaints of nuisance. About the year 1898 the tank capacity for precipitation was only equal to about two hours' flow of sewage. The experiments were made on a considerable scale, with double contact beds, the results proving most satisfactory. These experiments continued over several years, and were conducted with the assistance of Mr. W. J. Dibdin. About the year 1903 the late Mr. G. R. Strachan was instructed to prepare a scheme for the disposal of the town's sewage, which was eventually carried out. Mr. Strachan unfortunately died before the completion of the various contracts. The works were completed under the direction of his successors (Messrs. Strachan & Weekes) and opened in 1909. The site of the old works was transformed into a pumping station worked electrically on the energy supplied from the corporation's own generating station.

The sewage is screened on reaching the pumping station by means of three lifting screens, and one fixed screen, the three former being lifted for cleansing by an overhead electric traveling crane. Four Gwynne's centrifugal pumps for lifting the sewage to the new disposal works at Aylesford, 3½ miles further down the river, are provided, each equal to dealing with twenty-four hours' dry-weather flow of 1,000,000 gallons; so that during wet weather three volumes can be delivered to the works, leaving one pump as spare.

Three similar storm-water pumps, each capable of dealing with 1,500,000 gallons per twenty-four hours, or a further three volumes, are provided, so that during heavy storms six times dry-weather flow is dealt with, leaving one pump as spare on each section. This storm water is dealt with on a site of 3 acres adjoining the pumping station and the effluent from these filters is discharged into the original effluent sewer. The lift of the sewage pumps is 31½ ft. and that of the stormwater pumps 21 ft. The sewage is conveyed to the disposal works partly by a 24-in. cast-iron main, and for part of its length by an egg-shaped culvert 3 ft. 9 in. by 2 ft. 6 in., and the latter is laid through the ragstone at a depth varying to 50 ft. and for a distance of 1,000 yards. This portion was laid in a tunnel and the stone removed by blasting. The pumping main crosses the Medway before reaching the works by means of two 18-in. diameter steel tubes, controlled at either end by valves, so that either of these, or both, can be used at will.

At the works the sewage is delivered into four sedimentation tanks, each having a capacity of 375,000 gallons, or a total of 1,500,000 gallons. The tank effluent is afterwards passed through the percolation filters, ten in number, and 85 ft. in diameter, and of a depth of 9 ft., and the effluent passes into the Medway; and this, which is tested daily, has never yet been found liable to secondary putrification. The works were opened in 1909.

The present system of dealing with the sewage has been adopted after a series of experiments with a view to minimising an aerial nuisance from the treatment, and consists in passing the sewage through one tank only, and adding to the tank effluent, during the summer months only, from 2 to 6 grains of lime per gallon. It then undergoes a second precipitation, and the effluent, which is kept just alkaline by means of the lime, is passed on to the filters. It has been found necessary during very hot periods to add, in addition to the lime, a small quantity of bleaching powder to prevent any aerial nuisance from sulphuretted hydrogen being released into the atmosphere through the splashing of the sewage on the surface of the filters from the sprinkler arms. The distribution is by means of revolving sprinklers of the Candy-Whitaker type. The sludge is disposed of by ploughing it into the land after being air-dried in lagoons, and various crops are grown, consisting of potatoes, roots, clover, and rye-grass, etc. The area of the land attached to the works is 28 acres.

The total expenditure on the scheme has been just under £70,000. The loan for purchase of land was for sixty years for building sand tanks, filters and pumping mains for thirty years, and for machinery twenty-one years.

The working cost of the pumping station for the year ending March 31st, 1917, was £1,900, including wages £726, current supply £593 and rates and taxes £437; that of the disposal works being £1,591, including wages £299, and rates and taxes £919 9s. 5d. The produce of the farm at the disposal works amounted to £362.

The life of a marine boiler depends to a certain extent on the care and attention bestowed on it during the first few months of its existence, provided that the plates have been properly treated at the building of the boiler—that is, all mill scale removed and the plates kept dry and free from atmospheric corrosion. The mill scale, if not removed, has a very irritant action on the clean metal of the boiler, and is most hurtful to the plates if allowed to remain on them. When new boilers are put under the varying conditions and temperatures found on ship board, the greatest care and attention is needed for the first period of working if the boilers are to be kept free from corrosion; the new metal of the boiler at this stage being most open to attack from all sorts of corrosive agencies. It is advisable on the first voyage to put into the boilers before closing them up 5 lb. of lime per 1000 I.H.P., and afterwards for a period of about six days 2 lb. of lime per day per 1000 I.H.P. should be passed through the hotwell as milk of lime, and 1 lb. of lime per day per 1000 I.H.P. during the remainder of the voyage.

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*Borough Engineer and Surveyor, before Institution of Municipal and County Engineers.

The Sanitation of Factories

By Philip Ring[*]

THIS subject may be briefly summarised as follows:—General Ventilation, Local Ventilation, Toilets, Drinking Water, Cleanliness, Washing Accommodation, and a few other matters which may be referred to briefly.

Any one of these phases of sanitation with its many subdivisions or side issues could be developed into a lengthy paper; consequently it will be understood that many important features of the subject must remain unnoticed.

The subject of ventilation in factories is, generally speaking, one of the most difficult connected with factory sanitation. While we have not in this province the great congested centres of industry, nor the very large manufacturing establishments, that are so prominent in other places, nevertheless we have the problem of ventilation with us.

In dealing with the subject of ventilation in industrial establishments it is customary to divide it into two parts: general and local ventilation. General ventilation deals with the conditions of air in a factory while local ventilation applies to the removal at the point of origin, and before mixing with the air of injurious dust, gases, fumes, etc., generated during the manufacturing process.

The open window is, to a large extent, the only means of general ventilation. The cold draught from open windows very often cause the windows to be closed, thus preventing the admission of fresh air in that manner. Again, owing to the nature of some industries, windows must be kept closed on damp or wet days, as the moisture will affect the goods.

When the weather is warm enough to open doors and windows, Nature may be allowed to do the ventilating, but when it becomes necessary to heat buildings, the subject of artificial ventilation must be considered.

Generally speaking, in factories the question of ventilation seems to be how to provide fresh air in workrooms and remove the vitiated air during the season when doors and windows must be closed. With sufficient heating facilities and the use of window ventilators this difficulty could to a reasonable extent be overcome.

It is an unfortunate fact that most employers do not give the subject of artificial ventilation the attention its importance deserves. Factories are erected without giving any consideration whatever to the matter. Eventually, finding that some means must be employed to cool an overheated workroom or to remove some noxious gas or fumes, an open propeller fan is installed at a window, and the last condition is worse than the first. The dust or fumes from some machine or other process of manufacturing is drawn, often from the opposite side of the workroom, past the breathing level of the workers, with results which will be apparent.

Open Fan is Objectionable.

Another objectionable feature of the open fan, when its installation is not properly considered, is that the large volume of air exhausted must be replaced, and this replacing air will rush in through any opening such as doors, windows, elevator shafts, etc., causing such a draught that the fan must be stopped.

Were the time at my disposal I could continue to discuss this question of open fans almost for the whole time of your meeting, but it can be said that employers have wasted considerable money, and workers have to contend with unhealthful conditions, because an expert was not consulted when factories were being erected or when artificial methods of ventilation were being installed.

Heating and ventilation should be considered as inseparable if ideal conditions are to be attained. In many workrooms, in cold weather, a reasonable temperature is only obtained at the sacrifice of all ventilation. An ideal method of heating and ventilating known as the plenum system, which is intended to give a continuous supply of fresh air, is in use in a number of large industries. By this system the air is drawn through a heater by a fan and forced through air ducts to all parts of the building. The entering air is forced into the building under pressure in a constant volume, which must displace an equal quantity of air; hence the ventilation is positive if the system is properly connected with the outside air, similar to any ordinary hot-air heating system in a house.

Very often we find that the fresh-air inlet is omitted, one side of the enclosure about the heater is left open, and the ordinary air of the factory with its impurities is drawn into the system and used over and over again. Thus, what was intended for a heating and ventilating system is rendered useless so far as ventilation is concerned.

Local Ventilation.

No industry is free from dust. As can be readily understood, it is a result or accompaniment of occupation. The importance of dust as a factor in disease and occupational mortality you will, of course, recognize. To remove dust or other impurities generated in the process of manufacture, the principle of local ventilation is applied: that is, an exhaust system devised specially for their removal locally at the point of origin, thus preventing them from mingling by branches with a main duct; and an exhaust fan draws the material to be removed through the branches and duct and deposits it in a separator or dust chamber.

As in the case of open fans, already referred to, there has been considerable disappointment in the construction of exhaust systems. Many persons think it is a simple matter to design a proper dust-conveying system. In reality there are a number of points which require careful and intelligent handling.

Various considerations enter into almost every case to determine the proper arrangement of the hoods and piping, so that it is impossible to lay down any hard-and-fast rule. Indeed, it should be stated here that the design of such a system, and the various problems arising in its installation, should be referred to those whose previous experience in such matters places them in a position to provide a successful and economical system.

A large number of these exhaust systems are now in use in this province. Such a system is used to remove the fumes from the lead pot of a type-setting machine as well as the smoke and gas from a furnace.

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[*] Inspector of Factories, Halifax, Nova Scotia.—Before the Association of Medical Officers of Health.

It is operating in every woodworking factory of any importance to remove the shavings and sawdust from the machines. Grinding and polishing wheels are equipped with this system. Ropeworks and foundries are using it. In fact, the system can be be made useful in almost any industry.

The relation of industry to mortality has been the subject of careful and exhaustive investigation by medical experts in all industrial countries, and your own experience will no doubt agree with their conclusions that the high death-rate from pulmonary diseases among industrial workers is due largely to the inhalation of dust, fumes, gases, etc., incidental to their occupations. The figures which some of those investigators give, when comparing the death-rate from certain diseases between factory workers and those employed in the open air, are such as to emphasize the importance of local ventilation.

Ventilation of factories is a most imoprtant phase of sanitation and should receive the careful attention of those who are engaged in the conservation of public health. It is a fact that most workers do not notice the bad condition of air in a workroom. Even the presence of gas or some other noticeable impurity is not often detected except by a person coming in from the outside air. After all, the human element is the important factor, and improvements will not move much faster than the development of the workers' knowledge of the subject.

Sanitary Condition of Closets.

Perhaps the most difficult subject the factory inspector has to deal with is the sanitary condition of closets. How to secure proper ventilation, plenty of sunlight, proper separation of sexes, removal of closets from workrooms, and have them kept in a sanitary condition, are perplexing problems, when the situation, available space, and other circumstances peculiar to each case are taken into consideration.

While we have many excellent examples of lavatory accommodation in our factories, we have also many establishments where the toilets are always in an unsanitary condition. It is unnecessary for me to dwell on this latter condition, only to remind you how much it may be aggravated when it occurs in a food producing establishment.

It may be asked, "Why is it that those unsanitary conditions occur?" It is due mostly to faulty construction and also to the filthy habits of some workers. We have not in this province any standard requirements regulating the construction of closets. The plumbing in some localities must be inspected, but otherwise employers are at liberty to select the location and erect the closets to suit themselves, and it very often happens that even ordinary sanitary principles are neglected.

If closets are erected in dark corners they will usually be found in an unsanitary condition. Darkness seems to invite carelessness. The question of light and local ventilation is not considered; in fact, it appears at times as if those essentials of sanitation were deliberately ignored. The material used in construction is not selected with a view to suitability. It cannot be expected that such places, even with care, can ever be kept in good condition.

Regarding the filthy habits of some employees, we will agree is is a difficult problem to deal with, but it is being dealt with, and where the management have made a determined effort the trouble has been eliminated. My experience in those matters has been such that I am convinced, where closets are properly installed and given the care and attention they require, as a rule no fault can be found; where they are otherwise, it is mostly due to lack of determined effort on the part of the employers.

If we are to make any substantial progress in this matter of toilets, we must have some standard regulations governing their erection, such as the following:—

> Water-closets shall be readily accessible to the persons using them. The entrance to every closet which opens directly into the workroom shall be screened from view by a vestibule. No closet or urinal compartment may be maintained in connection with rooms in which food products are manufactured or wrapped, unless such compartment is separated from such rooms by a vestibule with doors.
>
> Every toilet-room shall have a window opening directly to the outer air. Fly screens shall be provided for toilet windows when necessary.
>
> The floors of every toilet-room, and the side walls to a height of four feet, shall be constructed of material, other than wood, which is impervious to moisture and which has a smooth surface. The outside partitions of every toilet-room and of every closet not located in a toilet-room shall be of solid construction and shall extend to the ceiling.

There are a number of other requirements regarding the fittings, doors, partitions, etc., which deal with the moral as well as the sanitary requirements.

It will be easily understood that the occasional visit of a factory inspector will not be sufficient to enforce good sanitary conditions where the employers are not well disposed in that direction. It does appear that the health authorities, at least in the industrial districts, might extend their activities by occasionally visiting the industrial establishments.

Water Supply.

Most people now understand that the question of Water Supply for drinking purposes, and the method of supplying it, are very important phases of sanitation. There can be no doubt that the water which the employees of mills and factories drink in large quantities during warm weather has an important relation to their health and efficiency.

While manufacturers are very careful about this subject and adopt the best method to improve conditions, still it must be admitted that there are times when the drinking water in some localities is dangerous, and also that the common drinking-cup is very generally used. However, the signs of improvement are encouraging. It is not uncommon now to meet workers who have their own drinking glass. Sanitary drinking fountains are being used in a number of factories, and there is evidence that their use will increase very rapidly. You will appreciate the sanitary benefits of the bubbler drinking fountain.

Further progress could be made in this matter if our law required that pure drinking water should be supplied, and where any doubt existed, that it should be submitted to laboratory examination. The use of a common drinking cup should also be forbidden.

Meaning of "Cleanliness."

Cleanliness appears to have various and widely-different meanings, and it is, therefore, a difficult matter to deal with successfully. Nothing is so unpleasant as to have to tell an employer that his factory is dirty. The statement is humiliating to the ordinary person, and employers as a rule resent it. Nevertheless it is necessary at times to remind some employers that their workrooms must be kept clean.

There are many employers who have a high standard of cleanliness, and there are also many who altogether neglect the most elementary sanitary methods. In the latter places all kinds of dust and refuse are allowed to accumulate on the floors, walls and windows; the workrooms swarm with flies in summer, utensils are badly kept, and a general lack of cleanliness pervades the whole place.

I said at the outset that this was a difficult subject to handle successfully. My meaning may be readily understood when one considers the task of persuading the proprietors of such places that they should clean floors, walls and windows regularly, provide fly screens for doors and windows, limewash occasionally, and otherwise put into practice the ordinary principles of cleanliness. The work of keeping places where food is manufactured in good sanitary condition can hardly be accomplished by a visit from the factory inspector once or twice a year. Such places should be visited at least at least once a month by the local health authorities, who should have special laws and regulations regarding them.

The spirit which prompts a man to limewash a machine shop and that which allows another man to neglect the most ordinary care of a workroom where food is manufactured will explain the widely-different views mentioned in the opening paragraph on this subject. Law is not necessary to the person who is naturally inclined to be clean, and I am afraid its application is of doubtful utility in the case of those who are otherwise disposed. If the public who are using the products of those establishments would investigate the source of their supplies by occasionally visiting them, a better condition of affairs would prevail, as the surest way of reaching such people is through their pockets.

At some occupations the workers perspire freely and become very dirty. How necessary and how refreshing a good wash is for this class of employees before leaving the factory! Many factories have good washing accommodations. This law should authorize the factory inspector to order good washing facilities wherever he considers it necessary.

The pernicious habit of spitting, which is prolific of so much harm, is altogether too common in our factories. In workshops it is said to attain its highest efficiency as a destroyer of public health. Employers should be compelled to provide sanitary cuspidors in factories. The efforts of health authorities are making a noticeable improvement in this respect.

In conclusion, I may say that while we have many deplorable sanitary conditions in some of our industrial establishments, there are also many employers who are giving commendable care and attention to the subject. There is, more over, a gradual improvement every year, and among both employers and workers there seems to be developing a more intelligent view of conditions. We will continue to be handicapped in the enforcement of good sanitary conditions in factories until we have standard requirements or regulations governing many of the matters referred to.

Financing Western Road Improvements

FROM time to time the Contract Record has been favored with contributions by Mr. A. McGillivray, Highway Commissioner of Manitoba, covering the general highway situation of that province, regarding new roads and bridges and their maintenance, and we reproduce herewith a further interesting article on the subject of "Financing Road Improvement," which Mr. McGillivray read recently before the Engineering Institute of Canada. This paper is of special interest to the municipal engineer and to all municipal authorities:

Financing Road Improvement.

The question of financing road improvement is one in which the Municipal Engineer should be much interested, and with which he should be somewhat familiar. While the actual cost of building a piece of road or the method of acquiring the funds to perform the same do not enter into its theoretical design or practical construction, still they have a direct bearing on the type and standard that should be adopted for any particular locality.

Generally speaking, roads are established and maintained in a country for the purpose of developing its commercial and industrial life. Doubtless the development of a country's social life is much effected by the roads existing within its borders. In fact the benefits ensuing from good roads taken from the latter viewpoints are almost immeasurable. Nevertheless, the commercial aspect of the question is the one generally viewed by municipal authorities and engineers when planning the construction of a road or system of roads, and the problem of determining the standard to be constructed in a given case resolves itself into a question which is largely economic. Therefore, the question should be asked and established: will the benefit secured from the construction of a certain high standard of road justify the financial expenditure involved? before such road is built in that community. Some people have a tendency to adopt the principal that the best, meaning the most expensive, is the cheapest in the end. This is only true to a very limited extent in road construction and where actual traffic conditions demand, or where, in the near future, it may be reasonably presumed that they will demand the highest standard of construction. The type of road that should be built is one that will produce the necessary convenience with the least annual overhead cost for maintenance, in addition to interest on initial expenditure.

Roads being a public utility; the cost of producing them should be shared by all, on as fair and equitable basis as can be devised, and to this end the principal of Government assistance, especially on main trunk roads and main roads to markets, is justifiable.

In Manitoba, the Provincial Government assumes certain proportions of the cost of building the aforementioned class of roads under "The Good Roads Act, 1914" of the Province. On main trunk roads radiating from the larger centres of population and connecting enroute the towns and villages, the proportion borne by the Province as a whole is 66 2/3 per cent of the cost, the balance being paid by the municipality or municipalities through which the road passes, each municipality affected bearing 33 1/3 per cent of the cost of the section within its boundaries. The larger portion of the cost of these roads is borne by the government on the assumption that they are used to a greater extent by non-residents of the municipalities through which they pass than by the local residents, a condition which with the increased use of the automobile as a popular mode of long-distance travelling, will be largely augmented in the future.

On main market roads, the Province pays 33 1/3 per cent of the cost of constructing earth roads, and 50 per cent. of the cost of gravel, macadam or other types of a higher standard than the common earth grade. The extra assistance is given on the superior type of road on account of the heavy cost of obtaining the materials suitable for road surfacing in many of the municipalities of this Province, and also an incentive to the municipalities to undertake the building of gravel and stone roads on their main lines to markets.

The cost of bridge construction on the two systems above mentioned is shared by the Province in the same proportion as on road construction. On bridges, which are not situated on a good roads system under the meaning of the Act, the Government also contributes to the cost of permanent structures, entailing an expenditure of $200.00 or over, and 33 1/3 per cent on structures of a temporary nature such as timber and costing $500.00 or over.

The funds to provide for government assistance to municipalities under "The Good Roads Act, 1914" are borrowed as a capital charge on the Province, being raised by the issuance of provincial bonds or debentures. The present Act provides for the issuance of $2,500,000.00, of which up to the present time about $1,250,000.00 has been used.

The act also gives the municipalities power to issue municipal debentures to defray their share of the cost of works being performed in the improvement of roads, limiting the amount that can thus be raised by a municipality to 6 per cent. of the total assessed valuation of all its taxable property, and as shown on the last revised assessment roll of the municipality. The rate of interest that may be paid on such debentures is limited to 6 per cent, and the currency of the debentures must not exceed 30 years. They are retired within the stated time by equal annual payments of principal and interest, thus eliminating the necessity of a sinking fund or of making other provisions for the repayment of principal at the expiration of the debenture period.

The retiring of rural municipal debentures by the serial or fixed annual method has much to commend it over other methods, as in many rural districts the establishing of a sinking fund for this purpose imposes an undue responsibility on a rural council, the members of which in many cases are inexperienced in handling this class of business and unless the trust funds were deposited with the banking institutions of the province at a considerable loss of interest, their reinvestment would be more or less precarious. The policy of the Government of the Province in this respect is to relieve the municipal authorities of this responsibility by insisting on the issuance of serial debentures, which, with the guarantee of the Government of the Province endorsed thereon, makes them a more acceptable investment to the purchaser, and a safer business transaction for the municipality. No indebtedness by which the security of the municipality is mortgaged, should be incurred without the consent of the ratepayers affected. The Manitoba Good Roads Act requires the assent of a majority of the ratepayers actually voting to a by-law authoriing the Council to issue the stipulated amount of debentures before such authority is legal and binding.

The financing of road construction by the issuance of long term debentures, say up to 25 or 30 years, is in the opinion of the writer, a most legitimate method. Certainly the large amount of this work that is so urgently required in this country at the present time could not be done on the "pay as you go" plan. It is not, however, a question of the end justifying the means. Such works as drainage, earth grades, concrete and steel bridges and culverts; essential features in road construction, may well be considered permanent works with resultant benefit extending far into the future, and it is unfair indeed to ask the present day ratepayer to pay at once for works of this nature. Again the securing of sufficient funds to undertake the construction of a system of roads permits the work being completed in shorter periods of time under more efficient organization and management, thus ensuring better work, more continuity of plans and immediate enjoyment of the resultant benefits. The cost to the ratepayer in pursuing such a method does not necessarily entail a larger annual outlay than that at present being levied in many municipalities in endeavoring to construct roads in such lengths of sections as their respective yearly appropriations will permit. Many municipal councils in Manitoba are spending annually on road work as much as from $10,000.00 to $15,000.00 without getting very far in a connected system of highways. Now, from the capitalization of such an amount or even a portion thereof, a very considerable fund could be secured with which to complete a substantial system of roads. For instance, for several years previous to 1912, the municipality of Wallace, in Manitoba, was spending $15,000.00 annually in endeavoring to improve road conditions there, with very poor results, the bulk of the money being spent in grading sloughs without any attention to drainage or other permanent work. In 1912 the Council decided to take advantage of "The Good Roads Act" then in existence and with the assistance of the Department Engineers, laid out a plan of work comprising the building of 198 miles of road. Debentures to the amount of $198,000.00 have been issued by the municipality, which amount with the assistance of the Province of a like amount, will carry the scheme to a satisfactory completion, giving the municipality 198 miles of well-built gravel roads properly drained and bridged throughout with permanent concrete structures. The annual levy on the ratepayers of the municipality to meet the indebtedness thus incurred is $12,205.53, or about $3,000.00 less than when the scheme was undertaken, which latter amount will more than maintain the mileage constructed for a number of years until the renewal of gravel surface is needed. Provisions for proper maintenance is a most essential feature in highway improvement work, especially should provision be made therefor where construction has been effected by debenture proceeds. The Manitoba Act places the responsibility and expense of maintaining roads built under government assistance on the municipality; but reserves the right to the Government of performing such work as may be necessary in this connection and levying on the municipality for the money so expended should the Council neglect or fail to maintain the same.

First Electrically Welded Ship Launched

THE advent of the electrically welded ship establishes another milestone in the shipbuilding industry responsible for many surprises in its efforts to cope with the situation caused by marine losses. An article recently published in the "Engineer" furnishes us with our first information of authority, and contains comparisons of great interest:—

Electrically-Welded Barge.

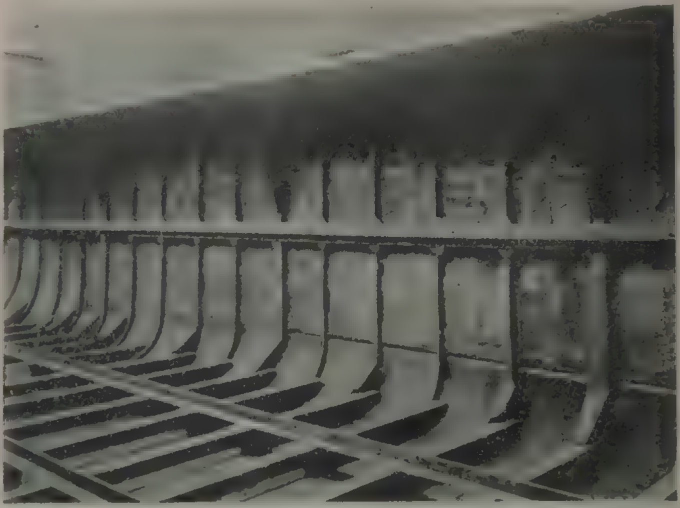
Particulars are now available of the interesting—and completely successful—experiment in rivetless shipbuilding, carried out at a yard on the South-East Coast. The first steel vessel constructed entirely without rivets was recently launched in the presence of Lord Pirrie, the Controller-General of Merchant Shipbuilding and, other representatives of the Admiralty and the war-office. She has since been in service with full cargo during exceptionally rough weather, and has, we understand, passed satisfactorily in every way through the severe tests imposed.

The object of the experiment, to which considerable importance was attached by shipbuilding authorities, was to prove the ability of welded construction to withstand the stresses peculiar to a ship at sea. This principle having been established, it is not proposed altogether to dispense with riveting, which in certain sections is cheaper and quicker than welding; it is intended, however, that future vessels should be a combination of riveting and welding. The United States Shipping Board, for instance, having been in close touch with the experimental work, is making arrangements for the construction of a number of 10,000-ton standard ships, in which the use of rivets will be reduced to 2½ per cent. of the number originally required.

The recent progress achieved in electric welding by means of the flux-coated metal electrode process, and its successful use at Admiralty dockyards and elsewhere in the construction of the equipment and superstructures of various vessels, led to permission being obtained for the erection of a standard barge, with riveting eliminated and electric welding substituted throughout. Such a craft, it will be observed, may be exposed to considerable rough usage in dock, besides being subjected to severe towing stresses. Seeing that material already available on the site where she was built was utilized, the barge differs in no way from the standard riveted type with lapped joints, excepting that the hull plates were arranged for clinker build and the plate edges joggled to permit of horizontal downward welding in order to reduce the amount of overhead work, which is more difficult of execution.

The vessel to be welded was 125ft. between perpendiculars, and 16ft. beam, with a displacement of 275 tons. The hull was rectangular in section amidships, with only the bilge plates curved. It was built up of seventy-one transverse frames, and contains three bulkheads, those fitted fore and aft being water-tight, and that amidships non-water-tight. The shell plating was ¼ in. and 5-16 in. All the joints were lapped in the manner described.

Curiously enough, the first day's work was poor, though all the operators were first-rate men, with extensive experience of electric welding in the shop on minor repairs and on structural work at shipyards. The poorness of the work was probably due to the novelty of the undertaking and to the position— lying flat on the keel—which the men had to adopt to get to the joints. In a few days, however, when they became accustomed to the job, the speed and quality of the work improved so as to become equal that achieved in workshop standard practice. With the more difficult welding, such as that in the vertical butt joints on each shell plating, and overhead work underneath the keel and on bilge plates it was noted that the quality of the welds was excellent. For this overhead work special electrodes were employed, and proved well worth the slightly increased cost. All water-tight joints up to and including the underside of bilge plates were continuously welded both inside and outside, the other water-tight joints being welded continuously on one side and tack welded on the other. On the shell plating the continuous welding was on the outside in all cases. For internal non-water-tight joints and frame construction tack welding was adopted, the length of welding being carefully calculated to give a margin of strength over a similar riveted joint. Taking all positions of work into consideration, the average speed was 4 ft. an hour at the commencement, while towards the end of the work an average of 7ft. an hour was easily obtained.


View showing welded shell plates and transverse frames.

Some interesting details have been given to us of the comparative cost of an electric welded and a riveted barge. In labour, 245 man hours were saved in construction, which can easily be improved on in future work. More than 1000 lb. of metal was saved, owing to the absence of rivets, but it is estimated that greater economy will result when the design is modified to suit electric welded ship construction. The total cost of welding was £301, detailed as under:—

Electrodes	£178
Electric current	61
Men's time	62
	£301

It is realized by the Admiralty experts that the proportion of cost for electrodes is high, but this is mainly due to the present limited demand. Demand and competition will have the usual effect, and should reduce the cost of this item by at least 60 per cent.

It will then be possible to build a vessel of this size with an estimated saving of from 25 to 40 per cent. of time and about 10 per cent. of material.

It is interesting to add that, as a result of this demonstration, the yard has prepared a new design of barge, in which it is proposed to incorporate electric welding and riveted construction to the following extent:—

To Be Welded.

Coamings.
Shell seams to frames.
Deck butts to beams.
Bulkheads (including boundary bars.)
Keel plate butts to be welded overlaps.
After shell seams welded.

To Be Riveted.

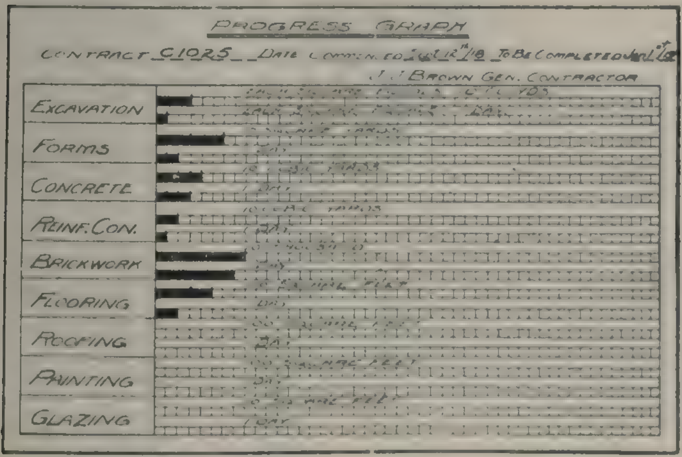
Floor riveted to frames.
Beam knees to frames and beams.
Frames clear to shell seams.

The Value of Production Charts in Checking Progress

INTENSIVE production in every industry has necessitated a recording of the work of every machine in the plant equipment. To be of value, this record must be tabulated in such a way that it is possible to see at a glance the output of any machine for a certain day; also the time and cause of any stoppage or delay in production.

Graphical records make clear the causes responsible for any reduction in output. They are of great value in studying the operations of any part of the equipment of an industry and show at a glance whether it is lack of orders, lack of help, shortage of raw materials or tools, change in lay-out or repairs resposible for the slow-up or idleness, causing a slump in output.

To be of value, charts should be prepared for individual departments, as it is only by this means that a loss incurred by one department is not charged, or at least a portion of it, to another department. In fact it is a common thing for some departments to have to share the expenses incurred by the over-development of some other department.



In charting costs, allowances must be made for interest and maintenance charges, depreciation, rental and supervision, etc. This is a part of the operating expense. If a machine is idle its share of the operating expense must be charged against it; otherwise the other departments will have to shoulder it, which will, unfairly, increase their operation costs. By means of these charts it will be possible for the manager to have available for reference, not only the lost time of each unit, but the principal causes of the loss of time. A graphical chart will greatly assist in stimulating everyone in a responsible position to reduce idleness to a minimum. A graph will show at a glance what would otherwise require a long careful study of figures.

The illustration shows a typical graphical chart that might be utilized by the general contractor. Each contract of course would have to have a special graph designed for that particular job. A tracing could be made and a vandyke negative made from the tracing. From this as many prints could be struck off as would be required. The illustration is shown merely as a suggestion. A contractor might possibly find it to his advantage to have a separate graph for each trade. The several foremen could turn these in each night and from them the superintendent could make up a weekly or monthly chart. A work schedule would have to be drawn up and a comparison between the chart and schedule would show at any time whether or not the progress was well balanced and up to date. A reference to the illustration will show the advantage it has over a mass of figures. A glance will show 30 cu. yds. of excavation in 1 day's work, 60 sq. yds. of forms in 2 days' work, 40 cu. yds. of concrete poured in three days, 20 cu. yds. of reinforced concrete in one day, 80,000 brick laid in 7 days and so on. This information is immediate and accurate and would be of great assistance to the contractor and his assistants.

Peterboro Going Ahead with Bridge Over Otonabee. Frank Barber Preparing Plans

THE city council of Peterboro, Ont., have instructed Mr. Frank Barber to prepare plans for a high-level reinforced concrete arch bridge to span the Otonabee River at Hunter St., connecting the main part of the city with an important business and residential section. This structure will replace a low-level double-span steel truss bridge at the same site. The only other connection between these two parts of the city is the Smith Street bridge, which is out in the suburbs. The total length of the new structure, including fill, will be 1,800 ft. How much of this will be bridging remains to be worked out, but it will probably be in the neighborhood of 1,000 ft. The floor will be about 46 ft. above water level, a few feet above the top chord of the old structure. The high-level is necessitated in order to avoid five railroad sidings which run in to the Quaker Oats plant, at the same time leaving the river open for navigation and accommodating the Quaker Oats Co. who do not wish to locate the main offices of their new plant at the low level. The width of the roadway will be 42 ft. between curbs, with double street car tracks. Between the abutments of the old bridge the width of the river is 245 ft. and whether one, two or three spans will be used to cross it will be determined by the nature of the foundation available. Borings are now being taken for this purpose. The probabilities are, however, that a single span will be found the most economical. The preliminary estimate of cost is about $300,000.

Mr. Barber has a large staff on the job and is rushing the preliminary work with a view to having the plans complete and bids in hand before New Year, as the city is under agreement with the Quaker Oats Co. to have the bridge built by the end of 1919. The company made this stipulation when they agreed to rebuild at Peterboro, following the destruction of their former premises by fire. The project is a large one to handle in one year and the pay-rolls on the work will run about $10,000 a month.

Direct Method of Handling Concrete Aggregates with Trucks

A very satisfactory method of handling material is being employed by the Harrison Engineering & Construction Co., Buffalo, N. Y., on its 22-mile concrete road contract in McDowell County, West Virginia. The plan is described in Concrete Highway Magazine as follows:

The contractor is operating fleets of five 2-ton trucks. The bodies of these trucks are equipped with an end dumping device, and lately have been equipped with three lateral partitions, making four separate compartments, each containing one 2-bag batch of 1:2:4 mixture. Aggregates are received from a railroad which parallels the highway under construction. Sidings are available so the haul to the mixer is seldom more than 1½ miles, and constantly lessening as the mixer approaches. At these sidings an unloader is used to handle the stone which is received in hopper cars. The unloader consists of an electrically operated bucket elevator from a pit under the rails to a storage bin having a capacity of 15 yd. The bin is installed at a height sufficient to allow a truck to run along side and receive its charge of stone. The stone is measured on the truck by a stripe painted along the body.

The sand is discharged from the cars in stock piles from which it is shovelled by hand into a small compartment car, having four hinged measuring boxes at a height convenient to discharge into the four compartments of the truck. The car operates on a narrow gauge track, which is easily moved as the pile changes its shape.

The cement storage is also at the siding and when operations were first started, two bags of cement were placed in each compartment after the stone and sand had been deposited. This proved unsatisfactory, however, as the wind would blow the cement away and it also sifted from one compartment to the other.

This method of handling the aggregates saves labor. The records show an average saving in time of 30 minutes to every mile trip. The stone from the car to the mixer drum is handled by one man in the car to keep stone to the hopper, one mechanic to look after the motor and conveyor, two men to operate the bin gates and level the stone in the trucks. The sand is shoveled into the measuring boxes by four laborers and the instant the truck comes along side the boxes are tripped by these men.

When the truck arrives near the mixer it is turned and backed to the mixer hopper. There the truck body is elevated and each of the four batches are deposited in the hopper. In this operation, a boy mounts the truck body and unfastens the partitions as the batches are needed. Two men from the grading gang step back to see that none of the material spills on the grade. If this does happen they place it in the hopper and give the engineer the signal.

The advantages of this method are: A measured batch of aggregate, no waste of material on the subgrade, no foreign material in the stone, and a very little in the sand, fresh cement from the storehouse, and the saving in labor of eight shovelers and four wheelers on the stone and two wheelers on the sand.

Report of Hamilton City Engineer

THE annual reports of Mr. E. R. Gray, city engineer of Hamilton, Ont., for the year 1916 and 1917, have been recently issued in one volume. The 1916 report comprises fifty-seven pages and the 1917 report, sixty-four pages.

In his preliminary statement to the Mayor and Aldermen, City Engineer Gray draws attention to some special features. "Associated with the Roadway Division," he says, "a systematic periodic inspection has been inaugurated with excellent results." With regard to the Sewer Division, he states, "The Sewer Division is industriously proceeding with the work in connection with the procuring of information upon which to base the design of a system of storm sewers. Practical data is being secured and the study is now well advanced. The division constructed, by day labour, a number of local improvement sewers, tendering in competition with contractors."

It is also pointed out that the Division of Architectural Engineering had charge of the erection of extensive military barracks, which work was tendered on and awarded to the department in competition with city contractors, the construction being completed in record time, well within the estimate, thereby making a considerable saving to the city. This division is also making a systematic inspection, accompanied by a report, quarterly, upon all civic buildings under the control of the department, so that repairs or alterations can be promptly and satisfactorily made.

Mr. Gray calls attention to a condition in Hamilton, which is a cause of discussion in many of our cities, namely, the excessive pumpage per capita. He says, "The consumption of the city is still on the increase. The average pumpage of 127 Imp. gals. of water per 24 hours per person is considerably higher than the average consumption for American cities and almost twice the consumption of cities where water is sold on the meter basis." The total gallons of water pumped in 1917 was 4,996,489,493. In 1915, it was 3,779,251,231, or 103 gals. per capita, and in 1916, it was 4,474,711,870, or 117.3 gals, per capita.

There are two pumping stations in Hamilton, the Beach and the High Level, and there are four reservoirs—Barton, with a capacity of 11,000,000 gals., High Level, capacity 450,000, James Street, capacity 1,524,822, and the Mountain Water Tower, capacity, 800,000 gals. The water is pumped from the Beach pumping station to reservoir and direct; also re-pumped to High Level, Reservoir and Mountain Water Tower. In 1917 the preparation of estimates and plans for the reconstruction of the Beach Pumping Station to accommodate new steam and electric pumping units was commenced.

No local improvement roadway work was undertaken during 1916 or 1917, owing to the policy of economy adopted during the period of the war.

During 1917 a complete survey of all existing trunk sewers in the city was made in order to ascertain locations, capacities, etc. Gauges were installed throughout the city in flooded districts, Bristol Recording gauges being used where a continuous record of flow is required. Special manholes were constructed for their application. The total mileage of sewers completed up to the end of 1917 was 139.08, consisting as follows: Brick, 14.22 miles; concrete, 7.74; 24 in. vitrified pipe, 3.76; 20 in. vitrified pipe, 0.47; 18 in. vitrified pipe, 12.17; 15 in. vitrified pipe, 22.43; 12 in. vitrified pipe. 72.93; 10 in vitrified pipe, 0.352; 9 in. vitrified pipe, 4.83.

Industrial Housing in Three Rivers, P.Q.

THE year of industries for Three Rivers was 1917, and the beginning of 1918 saw floods of workmen rushed towards this city, which was confronted with the big problem of their boarding. Housing accommodations had to be found, but no more were available. Immediately the city council paid attention to this question and it came to the conclusion that at two viewpoints Three Rivers policy was to encourage the building of comfortable and convenient houses—(1) To increase the good standing of the town and to add to its embellishment; (2) To make the city more attractive for the workmen.

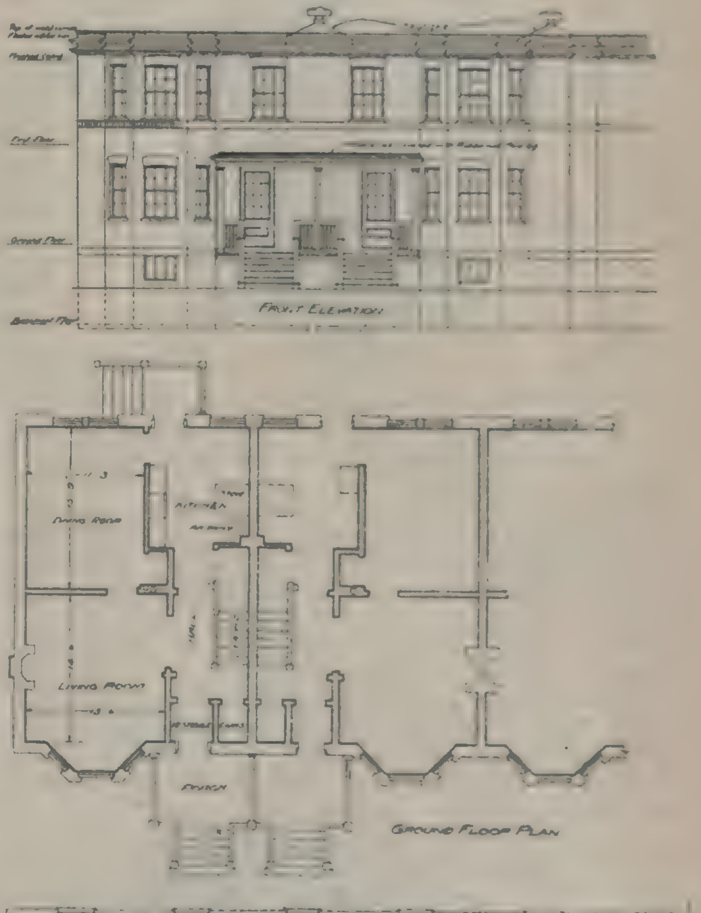
An interesting suggestion to the council was that the city itself go into the building line and sell or lease the houses with reasonable profits. It was opposed by many constituents, the principal reason bearing upon the point that decent dwellings could not be built at a reasonable cost on account of the high price of the materials, labor, etc. However, the scheme was not dropped. Every day local naval activities were calling for more men. Then the city came to an agreement with the Tidewater Realties Co., Ltd., a sister company of the Tidewater Shipbuilding Co., Ltd., and a subsidiary of the Canada Steamship Lines, Ltd.

The city was to furnish the site and the company agreed to go into the construction business on its own account. North of the Seminary property, the Houliston Park was lying idle for a long time, as far as building work was concerned. Tramways were passing across and in front of the property. The site was elevated and composed of a sand ridge. No better spot was available within the city and it was bought at a cost of $100,000 by the city council. It was granted to the company on the condition that they build thirty houses before the 1st of June, 1919, and the balance of lots as per a certain contract between the parties. Each house was to cost at least $3,500. The municipal revenue in taxes, water rates, etc., was estimated as sufficient to provide for the interest, and the sinking fund on the invested capital, which should be reimbursed in a short period on this scheme.

The company then retained the services of Messrs. Barott & Blackader architects, Montreal, to prepare plans for these industrial houses, and by the end of June a contract was closed with Mr. Anselme Dube, general contractor, Three Rivers, for the construction of five two-storey buildings, 132 ft. by 34 ft., built in terraces of six houses, consisting of sevenroom apartments. On the ground floor was a vestibule, a living room, a dining room and a kitchen; on second floor, four bedrooms and a bathroom. The work was started on July 1, and one of the buildings is nearly completed, the brickwork of three others is completed for the first storey and the foundations of the fifth one are finished.

The foundations of these buildings are of 1:3:5 concrete and the walls are 12 in. thick and eight feet high. The mixing was carried on with a ¼-yard London mixer operated by steam, and the concrete was handled in wheelbarrows. It took two days and a half to complete the foundation—the first one—at the rate of 50 cub. yds. per day. The unit cost of the concrete was $12.00. In the cellar the flooring is concrete. For every house there is a No. 200 Sunshine hot air furnace furnished by the McClary Mfg. Co., of Montreal, also a Wee Hawken concrete laundry tub.

The walls of the building are of solid plastic brick and the division walls in common brick. In each building there are 150,000 bricks. The floors are of 1 in. spruce, finished with ⅞-in. B. C. fir. The interior walls are lath and plaster on 3 in. x 3 in. studs. The trim is all in white pine, except the stairs, which are hardwood. Each tenement is supplied with a vestibule and a porch. A crown roofing is placed all around the building, which adds to its appearance. It is made of colored wooden shingles. Barrett Specification roofing is employed.



Elevation and plans of Three Rivers industrial houses.

The following sub-contracts have been awarded;

Foundations, Dallaire & Pothier, Three Rivers; Bricking, J. H. Giroux, Contractors, Three Rivers; Plumbing, Germains & Freres, Three Rivers; Heating, McClary Mfg. Co., Montreal; Electrical work, P. Rochon, Three Rivers; Sanitary supplies, James Robertson Co., Montreal; Cement, Cyrille Labelle & Cie des Trois-Rivieres.

The total cost of one building when completed is $24,000. Another contract has been awarded by the Tidewater Realties Co. to Mr. J. H. Hand, general contractor, Montreal, to build five four flat buildings. These are to be 37 x 40 ft., two storey. Work on their foundations is already commenced.

Guarding Valuable Property

Coal pilfering is quite a serious problem and with the increased cost of fuel, the coal pile represents a greater investment of money than ever before. Added to this is the impossibility of replacing any loss by ordering more coal, and it is reasonable that manufacturers and plant owners generally should adopt precautions to conserve their allotments.

No matter how loyal or how vigilant a night watchman may be he cannot be everywhere at once. Coal stealers take care to make their hauls when he is furthest away. The best safeguard is a protective fence a new type of which has been designed expressly for factories, munitions plants, etc., by The Dennis Wire & Iron Works Co. This fence stands over seven feet high and is topped by triple rows of barbed wire, overhanging at an angle that defies the would-be intruder. It is made of specially heavy wire mounted on steel posts, creating a "zone of safety" about the entire plant and forcing all to approach by specific centralized entrances, over which proper supervision may be maintained.

The Dennis people report that they are busy erecting this new chain link fence in all parts of Canada, and among recent hurry-up orders are furniture factories, stove works, munitions plants, tanneries, rolling mills and implement factories. One manufacturer found that within a month after putting up a chain link protective fence, he had made a big saving on costly brass castings which the men had been in the habit of throwing out of the windows during the day and collecting at night, to dispose of later at the price of scrap brass. Much material leaves some factories via the windows—a loss which is estimated by the police of one city at hundreds of thousands of dollars yearly in that place alone.

The Dennis chain link fence cannot be climbed, cannot be got through, around or under. It keeps all cranks, thugs, firebugs, enemy agents, agitators and thieves at a safe distance from the plant it protects, forming an impassable wall of steel that reduces insurance, protects property, stops losses and thievery and earns its cost generally in a short time. An illustrated explanatory folder has been issued by the Dennis people for the information of those interested, and as an evidence of the widespread concern over the important matter of adequate plant protection, the first edition is already exhausted and the second edition has just left the press.

The Tide-water Shipbuilders Limited have decided to build boilers and marine engines at their shipyards, Three Rivers, Quebec, and are putting up buildings and installing plant at their works, which it is expected will cost nearly half a million dollars.

Mainly Constructional

East and West—From Coast to Coast

That portion of the county road between Trenton and Belleville in Hastings County, Ont., has been taken by the provincial government.

Quite extensive operations are under way in connection with the C.N.R. terminals at Leaside. Round houses, freight buildings, office and work shops are in course of construction.

At a recent meeting of the council of Dundas, Ont., a by-law was passed authorizing the issue of debentures to the extent of $27,000, the funds to be used for the extension and improvement of the waterworks.

The barracks which Bate, McMahon & Co. have the contract to erect at Barriefield, near Kingston, Ont., will include 22 buildings, 11 of them 200 ft. long. Work is to be commenced at once and completed in 80 days.

It is understood that Bate, McMahon & Co. have the contract for clearing the land and erecting the new buildings for the casualty clearing station in Toronto on the heights overlooking North Rosedale and the new military hospital.

The R. Westcott Co., of Windsor, Ont., has been awarded the contract for the building of a new reservoir in Leamington, Ont., on a 7 per cent. commission basis, the cost of materials and labor being placed at $40,000. Work has already been started.

There were 159 building permits taken out in Winnipeg during the month of August, representing a value of $382,350, as compared with 134 permits at a value of $222,250, for the same month in 1917. For the first nine months of this year, the total is 1,011 permits, valued at $1,747,900.

The value of building permits issued in Galt, Ont., for the first eight months of the year is about $60,000 ahead of the corresponding period in 1917. The figures are: 1918, 131 permits valued at $140,285; 1917, 80 permits, value $81,600. During August there were 23 permits taken out, at a value of $30,350.

The council of Port Credit, Ont., is considering a plan of building 20 houses, taking advantage of the provincial government's offer. The amount to be borrowed will be $60,000. The class of house to be built will be a six-roomed brick, standard plumbing and electric lighted, to cost between $2,500 and $3,000.

By-law No. 1169 was recently passed by a special council in St. Boniface, Man., authorizing the city council to enter into an agreement with the provincial minister of public works regarding the paving of Marion street; the government is to pay one-half of the cost and at the same time a limit of $60,000 is set for the city's share.

The building permits issued in Brantford during the month of August indicate greatly increased activity in the trade. There were 27 permits taken out at an estimated value of $202,290, an increase of $191,315 over the figures for August 1917. For the eight months of the year, the total is $594,395, which exceeds last year's figures for the same period by $510,200.

An order-in-council has been passed giving the War Trade Board power of supervision and regulation of the Canadian steel industry. This action has been taken with a view to co-ordinating the productive power of the steel plants and securing the greatest possible efficiency. The War Trade Board has authority to instruct each company as to what it may produce. Each plant will likely specialize on particular materials. This step has been necessitated owing to the steel situation in the United States.

Building Inspector McKenzie's report for the month of August indicates greatly increased building activity in Vancouver as compared with last year. The August permits number 93 and are valued at $216,313, as against 52 at a value of $54,424, for the same month in 1917. This year's total for the first eight months is 558 permits valued at $1,011,318, compared with 359 at a value of $405,920 during the corresponding period in 1917.

Mr. Lyon, of Guelph, representing advocates of the Toronto-Guelph-London route for the proposed provincial highway, recently appeared before the Toronto board of control, asking the city's support of the northern route instead of the southern via Hamilton, London and St. Thomas. It was pointed out to him, however, that the highway was a provincial matter and that Toronto had no direct participation in it.

Hon. Edward Brown, provincial treasurer for Manitoba, recently announced that a railway would be built in the immediate future north of The Pas to strike the rich copper country in that location. The railway will not connect with the Canadian Northern at The Pas, but with the government road north of the Saskatchewan River, owing to the fact that it would cost a million or a million and a half to erect a new bridge across the river. According to Mr. Brown's statement, the road will cost about $2,000,000, there being a stretch of 70 miles to cover, for which an allowance of $30,000 a mile is made. The money will no doubt be provided directly by the federal government, the line being a feeder to the Hudson Bay line, on which work is now being completed. The copper country which the line will open up is said to contain very extensive deposits. At the Flin Flon mine 25,000,000 tons of copper ore have been diamond-drilled, the value of which has been estimated at $10 a ton. This property is now controlled by Toronto and Boston interests. No work is being done on it owing to the fact that the proposition is a huge one and the railway is needed as a preliminary step. Smelters will have to be built at the mine. The Mandy mine at Schist Lake, some distance south, is said to be very rich. It is now owned by the Tonopay Mining Co., of Nevada. Last year 1,500 tons were mined and shipped.

Personals

Mr. L. W. Bourassa, C.E., has been appointed city engineer of St. John's, Que.

Mr. W. P. Near, B.A., B.Sc., city engineer of St. Catharines, Ont., has been chosen to act as fuel controller for that municipality.

Mr. Arthur Sande, construction engineer in charge at Dominion Canners, Limited, Simcoe, Ont., has been engaged as construction engineer for the Kipawa Fibre Co., Ltd., Temiskaming, P.Q.

Mr. Leslie Hornsby, formerly of the engineering staff of the Grand Trunk Railway system, and latterly with the Toronto Terminals Co., has resigned and taken a position in the survey department of the Ontario Hydro-electric System.

Dr. J. W. S. McCullough, Medical Health Officer for the province of Ontario, who since the beginning of the war has attended to all sanitary matters in Military District No. 2, has been offered appointment as medical officer of the stationary hospital which is to go to Siberia with the Canadian expeditionary forces.

Mr. Chas. H. Rust, who for the past six years has been city engineer of Victoria, B.C., has returned to Toronto, where, it will be remembered, he also held the position of city engineer from 1898 to 1912. He has now associated himself with the Toronto Railway Co. and allied undertakings. Mr. Rust is a past president of the Engineering Institute of Canada and of the American Society of Municipal Improvements. He was born in Essex, England, in 1852.

Mr. W. H. Carter, of the Carter-Halls-Aldinger Co., has been elected president of the Winnipeg Board of Trade, by the eighteen directors who were recently chosen to form the board of management. The first act of the new board was to pledge the fullest measure of support of its entire membership of 2,000 to the success through personal service, of the next Victory Loan.

Mr. W. H. Carter.

Mr. R. Home Smith will be Ontario's New fuel commissioner, according to recent announcements, succeeding Mr. R. C. Harris, Toronto commissioner of works, who has been anxious to be relieved of his duties in this connection. Mr. E. L. Cousins, general manager and chief engineer of the Toronto Harbor Commission, will assist Mr. Smith, either as adviser to the commissioner or as Deputy Fuel Controller.

Lieut.-Col. John Stoughton Dennis, C.E., D.L.S., past-president of the E.I.C., and president of the Canadian Forestry Association, who has done such good work with the British Recruiting Mission in the U.S.A., has accepted an appointment in the Canadian expeditionary force which is going to Siberia, with which he will be employed in a special capacity.

Lieut.-Col. J S. Dennis, C.E , D.L.S.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Grand Mere, Que.
The Town Council contemplates macadamizing road to Great Northern Rly. Station, and paving St. Maurice Street, at a cost of $25,000. Engineer, Chas. Gelinas.

La Baie, Que.
Work is to start for an asphalt road for the Town Council. Secretary, N. W. Frechette.

Ottawa, Ont.
B. Blair & Co., Ltd., 23 Butterworth Bldg., are in the market for reinforcing and cement in connection with pipe for a $30,000 intercepting sewer.

Preston, Ont.
Tenders are to be called shortly by the Board of Works, chairman, Deputy Reeve Wismer, for the contsruction of an 8-inch sewer for the Town Council.

Ste. Therese, Que.
Tenders are being received until September 21st for the gravelling of the road of La Grande Ligne for the Town Council. Secretary, Ovide Forget.

St. Thomas, Ont.
Work is to start at once for an extension to sewer for the City Council. Engineer, M. Ferguson.

Smith's Falls, Ont.
By-law has passed for alterations to waterworks for the Town Council. Engineer, S. B. Code.

CONTRACTS AWARDED

Bienville, Que.
Work is to start at once for a macadam road costing $4,000 for the Town Council: General contractors, Therien & Guay, will be in the market for necessary equipment and material.

Burnaby, B.C.
Resurfacing roads at a cost of $20,000 for the Provincial Government. Department of Public Works and the Municipal Council: General contractors, Cotton & Company.

Hawkesbury, Ont.
Filtration plant costing $48,000 for the Town Council: General contractors, Archambault & Leclaire, 616 St. Denis St., Montreal; mechanical equipment, Norwood Engineering Co. of Canada, Ltd., Cowansville, Que. General contractors want prices on 30,000 common red brick and 500 tons of 1¼ inch crushed stone, and will let roofing, plumbing and heating.

St. John, N.B.
Water main costing $65,000 for the City Council: Contract for 16-inch pipe, Vroom & Arnold, B. B. N. A. Bldg., St. John, representing Canada Iron Foundry.

Railroads, Bridges and Wharves

La Tuque, Que.
Great Northern Railway and National Transcontinental Railway contemplate the erection of a union station costing $50,000.

Montreal, Que.
The G. T. R. contemplate the erection of a terminal warehouse. Chief engineer, H. R. Safford, 94 McGill St.

Ottawa, Ont.
The C. P. R. plans to build new siding to new plant of Beach Foundry Co., Broad St.

Swift Current, Sask.
Work is to start for a $12,000 stock yard for the C. P. R. Superintendent, Mr. Halkett.

Three Rivers, Que.
Spur line is to be built from main line to the Three Rivers Shipyard Company's plant, a distance of two miles, for the C. P. R. Div. engineer, W. B. Harper, Windsor Station, Montreal.

Toronto, Ont.
The C. P. R. contemplate the construction of railway yards, terminal buildings, etc.

CONTRACTS AWARDED

Dauphin, Man.
Work is to start next spring for a concrete bridge for the Town Council: General contractor, E. Pilgrim.

Longueuil, Que.
Work has started for a $4,200 steel and concrete bridge for the Parish of St. Antoine De Longueuil: General contractor, Arthur Daigneault, 15 Longueuil St.

St. Janvier, Que.
Steel bridge and concrete abutments costing $10,000 for the Municipal Council: General contractor, Gaudette & Lachapelle, St. Ours.

Twigges Island to Lulu Island, B.C.
Wooden bridge for the Provincial Government, Department of Public Works: General contractor, Wm. Greenless, 407 Cordova St. W., Vancouver, previously reported Empress Construction Co., in error.

Public Buildings, Churches and Schools

Halifax, N.S.
Competitive plans are being received by the secretary, S. J. Wilson, until September 28th, for the erection of "St. Joseph's" school costing $75,000, and "Bloomfield" school costing $65,000, for the School Board, 81 Sackville St.

Hamilton, Ont.
Tenders are to be called in about a week by the architect, F. W. Warren, Bank of Hamilton Bldg., for the erection of a $35,000 public school for the Township of Barton.

Durham, Ont.
Plans and specifications are with Father Flahaven, who is receiving tenders until September 28th, for the erection of a church for the Catholic Congregation. Prices wanted on all materials.

Manville, Alta.
By-law has passed for a hospital for the District of Manville. Architect, Mr. Blakey, Parliament Bldgs., Edmonton.

St. Lambert, Que.
The Town Council will shortly vote $50,000 for the erection of a solid brick fire station. Engineer, H. A. Gibeau.

St. John, N.B.
Tenders are being received by R. C. Desrochers, secretary of Department of Public Works, Ottawa, until noon, September 24th, for the construction of a temporary barracks.

St. Louis de Gonzaque, Que.
The congregation contemplate the erection of a church. Curate, Rev. A. Corrideau.

Winnipeg, Man.
Work is to start shortly for an extension to church for the Presbyterian Congregation. Pastor, Rev. Andrew Roddan.

Tenders are being received by R. C. Desrochers, secretary of Department of Public Works, Ottawa, until noon, October 4th, for the construction of convalescent wards, long active treatment ward, active treatment wards and neurological ward in soldiers' home costing $1,000,000.

CONTRACTS AWARDED

Chauvin, Alta.
School costing $12,842 for the Public School Board: General contractor, T. La Plante, Sr.

Dorval, Que.
Temporary barracks costing $225,000 for the Dominion Government, Department of Public Works: General contractors, Quinlan & Robertson, Ltd., 260 St. James St., Montreal.

Kelvin, Ont.
Foundations are going in for a $10,000 one-storey church for the Methodist Congregation: General contractor, John Rippenburg.

Medicine Hat, Alta.
Repairs to hospital costing $3,400 for General Hospital Board: General contractor, J. J. Brandon.

Mountrose, N.S.
Work is to start at once for a school for the Arlington S. D.: General contractor, M. M. Charlton.

Oyen, Alta.
School costing $15,750 for the Board

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St. Lawrence Power Co. Secure Power Privileges with Time Limit

THE International Joint Waterways Commission has assumed authority in the matter of the application of the St. Lawrence Power Co., and have granted this company permission to build their weir. The proviso is attached that it must be removed at the end of five years, of if the war should last longer, at the ending of the war.

In granting this permission the joint commission is evidently accepting in good faith the statement of the company that the extension is only required to meet war demands. The proviso attached is merely an evident intention to guard the rights of both countries in the St. Lawrence River. The placing of the time limit, though quite too long, if the war should end as soon as we all hope, leaves the final disposition of the St. Lawrence water powers entirely at the disposal of the governments. The gravest objection to the decision is probably found in the fact that when the St. Lawrence Power Company makes its claim four years hence, as they naturally will do, the onus of proof that the weir is adversely affecting the flow of the river rests with Canada. In all fairness the responsibility of proving their point should have devolved on the company that has received the benefit of the doubt during the four year period. The commission's decision reads as follows:

The Order as Granted.

The decision of the commission is as follows:

"It is hereby ordered as an interim measure that the construction of the said weir and its maintenance until the expiration of the term of five years from the date hereof, or until the termination of the presnt war, is hereby approved upon the following conditions:

(1) "That at the expiration of said period of five years, or upon the termination of the present war, whichever shall last occur, said weir shall be removed by the applicant, reserving, however, to the applicant or any other interested party the right to apply to the commission at least one year before the expiration of the said period for a further continuance of the said weir, and on such application the commission may approve of such continuance on such terms and conditions as it may deem appropriate and equitable for the protection of the rights and interests of the people on both sides of the line.

(2) "That the said weir shall be constructed and maintained in accordance with the plans mentioned, and under all the terms and conditions set forth in the permit granted by the Secretary of War, dated Sept. 10th, 1917, so far as the same are applicable.

(3) "That for the purpose of protecting the rights, property and interests on either side of the boundary from any injurious effect, resulting from the construction and maintenance of said weir, the commission will, during the term of its approval, herein retain jurisdiction over the subject matter of said application, and may make such further order or orders in the premises as may be necessary.

"Provided that in the foregoing order the commission shall not be deemed to have considered nor passed upon any question pertaining to the rights of the applicant to divert water from the St. Lawrence River."

Hydrated Lime in Concrete

ON another page of this issue, we reproduce the results of tests on the effect of hydrated lime in concrete on the compressive strength of various specimens. The increase in strength due to the hydrated lime seems rather remarkable, but when one considers the detrimental effect that excessive quantities of water have on the ultimate strength of concrete and that any decrease of this excess manifests itself by an increase in strength, the results are not so startling. Discussing these results, Mr. Norman G. Hough, the director of the construction bureau of the Lime Asspciation, under whose auspices the tests were carried out, argues that the increase in strength can undoubtedly be assigned to two reasons:—

First, as the hydrated lime was increased, the flowability and workability of the mixture was improved to such an extent as to permit it being placed with a lesser quantity of mixing water than that required for the concrete without lime.

Second, hydrated lime is of an hygroscopic nature and absorbs water at the time of mixing. This water is held mechanically by the lime, but it cannot be utilized in any chemical combination while the lime is hardening. The cement, however, has a chemical attraction for moisture during the seasoning period which is much stronger than the mechanical attraction of lime. The moisture is therefore drawn from the lime and utilized by the cement in the process of more nearly complete hydration, thus resulting in increased strength.

The figures sent out by this Bureau are the first tests published which indicate the performance of hydrated lime in field practice, and this makes the information all the more valuable. It has been the contention of those who have closely studied this subject that the true value of hydrated lime in concrete is not so pronounced in laboratory work as it would be in field practice. On account of the conditions being vastly different and the methods of mixing less exact, the possibilities for improvement in field practice are much greater and a material having the properties of hydrated lime has much better opportunity of showing its real value.

Wood Preservation

ALMOST every stick of wood is infected with spores of plant parasites previous to its delivery from the lumber yards. Lumber so affected, if exposed to air, warmth and moisture, is certain to develop rot which will eventually cause its destruction. If the wood is treated chemically to make it unfit for food for the fungi, the development of fungous growth is prevented. Creosoting is the most effective chemical with which to treat structural wood. The methods of applying are by painting, soaking or injection under pressure. The latter is by far the most effective, but good results are obtained from the other methods.

The cheapest building materials are very often the most expensive. Cheap lumber is always expensive. Permanency or long life reduces the yearly cost, eliminates the large item for repairs and results, naturally, in greater profits. Rotten lumber is dangerous and its replacement is an expense that considerably reduces profit.

In the United States, it has been estimated, there are 16,472,000 miles of fencing. The average farm requires 828.6 rods of fencing requiring at least 100 posts per year to maintain each fence. The cost of fence posts is steadily increasing and the available supply of durable wood is becoming less and less. If the farmer treated his cedar fence posts with creosote, he would cut the cost of fence maintenance in half. This is just one instance of saving the large sums required in repairs.

Shingles, when creosoted, will not warp or curl and will not rot in a life-time. To prevent decay, it is necessary to at least brush treat the points of contact before the lumber is assembled and erected; thereafter the surfaces may be brush-treated in the same manner as paint would be applied, and if a piece of wood is thoroughly treated with creosote oil, it is protected not only from decay, but it is also perfectly sanitary, as vermin cannot breed, nest or develop in or on creosoted lumber. In districts where white ants are prevalent, creosoting is the most effective means or arresting their destructive activities. Instances have been known where creosote oil has been used to protect electric light and telephone poles from woodpeckers.

Creosote oil is particularly suitable as a paint for certain buildings. It is a nut brown in color and is rather pleasing and durable. Its cost is less than half that of oil paint and in addition to protecting the wood from the weather it is a much better preservative than standard paints. The color is, of course, flat, but it is serviceable and attractive.

The brush method of application consists of two coats of refined coal tar creosote oil. If there is a large amount of lumber to be treated, it is possible to dip or soak the wood in creosote oil—to use the open tank system. The open tank system consists of immersion of the lumber in alternate hot and cold baths of refined coal tar creosote oil—that is the lumber is soaked for various periods in creosote, which is maintained at an average temperature of 180 degs. F., when it is changed to a cold bath, the temperature of which is maintained at less than 100 degs. F., or in lieu thereof, upon completion of the hot treatment, the heat is shut off or the fire drawn and both oil and wood permitted to cool at atmospheric temperature without removal from one tank to another.

The pressure treatment consists of injection of crude creosote oil under high artificial pressure into the wood in gigantic retorts or steel cylinders.

Creosote oil should, if possible, be heated to a temperature of 150 degs. F. before being applied. The practice of wood preservation means increased life of buildings and increased working power of every dollar.

Builders' Display Rooms

MOST builders and material dealers consider that if they have a good photograph to show a prospective customer, they are going a long way toward arousing his interest and closing a deal. Some enterprising ones insist on going much farther than this, however, and want to show him how the various parts of the house are likely to look when completed.

An American company whose lumber yard was destroyed by fire some time ago, have gone one better than this and in reconstruction have adopted quite a novel idea in the way of building display rooms. The place is now, in fact, a succession of rooms fitted up exactly like the rooms of a well ordered modern home.

The front corner is the office, attractively fitted. The next room back is the reception room. It contains handsome furniture, tables, home pictures, racks of plan books, etc., and is the place where the salesmen meet their trade to discuss building plans.

The client looks over the plans, which include hundreds of attractive homes of every price and description, including plans of interiors, built-in features home improvements and additions of all kinds. If there is some point that needs illustrating, no time or talk is wasted in trying to describe it. They simply escort him to the other rooms back of the store, all bordering on the street.

The rooms include living rooms, dining room, breakfast pantry, kitchen, bathroom and bedroom. These rooms are arranged in a long series, one after the other, and have one side open toward a long passage way, or show room. Customers can thus be conducted down this passageway and look into each room in turn.

The walls of these rooms are covered with wallboard; the finish is Arkansas short-leaf yellow pine. The floors are in quarterd oak, plain oak, maple, edge grain pine, and flat grain pine.

The Effect of Hydrated Lime on the Strength of Concrete

SOME interesting tests recently made on the effect which various percentages of hydrated lime in concrete have on the compressive strength of the latter, are contained in a report issued by the Hydrated Lime Bureau of the National Lime Manufacturers Association. One of the most important developments in connection with the use of concrete that has been made in recent months is the discovery that the strength of concrete is governed almost entirely by the volume ratio of water to cement. Generally speaking, a ratio of 0.4 to 1 gives maximum strength while a ratio of 2 to 1 gives practically no strength. It is well known that a mixture containing just sufficient water to develop maximum strength is of too dry a consistency to permit being worked economically; so it has become the custom of engineers to permit the use of larger quantities of water in order to allow the contractor to place the mixture in the forms without employing too much labor .

The difficulty with this compromise, however, is that the contractor generally uses too great a quantity of water. The engineer realizes that as the quantity of water increases, the strength of the concrete decreases; so in order to protect himself against too great a decrease he insists that the concrete be placed with the minimum amount of water that will permit reasonably easy handling. This minimum amount of water is usually not sufficient to satisfy the contractor, because he realizes that with slightly larger quantities of water the material can be handled with less labor.

Hence these two opposing factors govern to a great extent the strength actually obtained in the finished concrete and the logical solution of the problem is to introduce such methods as will reduce the water content to a minimum and meet the objection of the engineer, and at the same time improve the workability of the mixture to meet the objection of the contractor. The method employed by the State Highway Department of Delaware is the introduction of a percentage of hydrated lime and the results obtained are given below. The proportions of the mixture used by the Delaware State Highway Department in all of its road construction are 1:2:4.

These tests are of unusual interest because of the fact that they were conducted under actual working conditions, the test specimens being taken directly from the concrete as it was being placed. The results, therefore, give a true indication of the actual strength of the concrete in the finished road.

Those who have closely studied the action of hydrated lime in concrete have been frank in stating that the function of hydrated lime is to improve concrete under field conditions, a result not so apparent under laboratory conditions. The reason for this is that concrete specimens as made in the laboratory are prepared under most favorable conditions of workmanship and of a drier consistency than concrete as placed in the field. In addition, it is the usual custom to store laboratory specimens under water, in a damp closet, or in damp sand. Under these conditions the specimens have an opportunity to develop maximum strength, so that such specimens are practically perfect, and, other things being equal, the possibility for improvement is limited to the personal equation of the operator. In field practice the conditions are entirely different; the concrete is not so carefully proportioned or mixed; the water is not so carefully regulated, and the conditions of storage are not so favorable. The possibility for improvement of field practice, therefore, is governed not so much by the personal equation alone, as by the introduction of a material which exercises a mechanical influence over the concrete at the time of mixing, handling and placing, and which permits these operations to be carried out with the use of a minimum quantity of free water.

The following quotations are extracted from a letter by G. W. Hutchinson, testing engineer, Delaware State Highway Department, in which the results of his investigations are reported to Chas. M. Upham, chief engineer:—

"The specimens were 6-in. x 12-in. cylinders and were made at the same time the concrete was being placed upon the roadbed. A chute mixer was used. The cylinder form was filled by holding it under the chute and deflecting the flow of concrete from the road into the form. All specimens of one mixture were taken from the same batch in the mixer.

"The specimens were not tamped, but were struck off on top and then were covered in order to protect them from the rays of the sun, this being identical with the treatment given the road. After being covered for 24 hours, they were buried at the side of the finished concrete road, and at the time when moist earth was thrown on the road the specimens were included under this covering. They were left in place until they were six months old and received the same treatment as the road during this period and then taken to be broken."

"As the tests were started in November, it will be seen that the specimens were subjected to the Fall, Winter and Spring periods."

"Consistency of the mixture was determined by the inspector and myself in accordance with our ideas of an ideal working consistency. The amount of water was not measured as it was not practical under the circumstances, but the same consistency was maintained during the mixing by the agreement of opinions of the man running the mixer, the inspector and myself; that is, the specimens were poured when the consistency was unanimously agreed to by the three parties as being the same as that of the previously made specimens."

"At the end of the six months' period, the specimens were removed to the laboratories of the Henry S. Spackman Engineering Company, Philadelphia for breaking under compression with the following results:

Compressive Strength.

Percentages of Hydrated Lime based upon the weight of Portland Cement in the mixture

0% lime	2½% lime	5% lime	7½% lime
lbs. per sq in	lbs per sq in	lbs per sq in	lbs per sq in
3108	2908	3596	3514

2203	3640	4381	5092
2529	3476	3473	4498
2613 Avg.	3341 Avg.	3816 Avg.	4368 Avg

In breaking under compression, it was noted by the laboratory that failure of the coarse aggregate occurred in every cause.

A similar series of tests on portland cement mortars has just been published by Professor M. O. Fuller, Lehigh University, Bethlehem, Pa., in "Concrete," which shows that the addition of hydrated lime up to 10 per cent. not only increases plasticity, but also, in some measure, the tensile strength of specimens stored in water and in earth. Mr. Fuller reports as follows:—

Our stored specimens showed greater gain in strength up to the 10 day period when lime was not present. Longer storage periods showed results in favor of the addition of lime.

In order to make the two series comparable the same brands of cement, hydrated lime and stone were used. The main object was to determine the percentage of hydrated lime that was best to increase the plasticity and impermeability of the mortar and not effect the strength of the mortar. The storage conditions were reduced to three, outdoor air, water and soil, and the time of testing 7, 14, 28 and 56 days.

Besides the tensile briquettes, a set of 2-in.cubes was also made and tested in compression on a Universal testing machine.

Physical tests of the cement gave the following results: Specific gravity 3.08. Fineness, 18 per cent. retained on 200 mesh sieve. Normal consistency, 25 per cent. water. Tensile 7-day—neat cement—454 lbs. per sq. in. 1/3 mortar, 188 lbs. per sq. in. 28-day neat cement, 753 lbs. per sq. in. 1:3 mortar, 326 lbs. per sq. in. Compressive, 7-day neat cement, 4701 lbs. per sq. in. 1:3 mortar, 1130 lbs per sq. in. 28-day neat cement, 6737 lbs. per sq. in. 1:3 mortar, 1997 lbs. per sq. in. Physical test of Delaware river sand screened through a No. 10 sieve gave the following results; Weight per cu. ft., 97 lbs. Specific gravity, 2.63. Coefficient of uniformity, 2.78. Air voids, 38.9 per cent.

The proportions of sand and cement were taken by weight, the percentage of the total weight of the mixture being added to give what is known as working consistency, i. e., normal consistency plus 50 per cent. The hydrated lime was added to the dry cement and thoroughly mixed before adding the sand and water.

Test pieces, after being made, were stored, one-third in water, one-third buried in moist clayey soil, and the balance outdoor subect to the elements.

Summary of Results.

The plotted results indicate from 5 per cent to 12½ per cent. of hydrated lime may be added to cement mortars without seriously impairing the strength. A large number of contractors use 10 per cent. lime.

Averages of the value of tensile strength for the various ages give 10 per cent as the best value for air and water storage, 7½ per cent. for soil storage, and 5 per cent. as the best value for all three kinds of storage.

The real value of the addition of lime to cement mortars is the increase in plasticity or workability which is very desirable from the contractors' point of view.

Municipal Salvage in Its Practical Aspects

The subject of municipal salvage, or the utilization of waste materials collected by municipal authorities, was discussed with much earnestness and considerable profit to all who attended the twentieth annual conference of the Institute of Cleansing Superintendents held at Stockport recently. There was a record attendance of members and of delegates from local authorities. The Director-General of the National Salvage Council—Mr. David Currie—recognized the importance of the conference, and attended to give an inspiriting and highly informative address, whilst the council's chief technical adviser—Mr. J. C. Dawes—opened the discussion, which led to a very frank and instructive contribution of opinions from the delegates, who described the work carried out in their respective districts, so that all could benefit from individual successes. There is little doubt, we think, as will be seen from the report which appears elsewhere, that the City of Liverpool has instituted the most comprehensive and successful schemes of salvage of any city in the kingdom, and it may well be taken as a model and a Mecca to which representatives of other cities and towns may profitably make pilgrimages to inspect its methods, and learn how they are carried out; whilst Glasgow, Sheffield, Keighley, Manchester and Aberdeen are also highly successful. Mr. Currie referred in his address to the absolute necessity on national grounds of salving waste to the utmost extent, for we cannot provide tonnage to import the materials we need, and he described the drastic regulations in force in Germany to compel the utilization of waste materials, whilst Mr. Dawes, in opening the discussion, adverted to the necessity of applying scientific methods so as to secure the full potentialities from salvage. Every municipality, he suggested, should possess its own salvage department, and he emphasized its importance by pointing out how millions of tons of cinders, the value of which, after screening, was now 18s. per ton, were wasted, much of it being consequent upon the use of inefficient fire-grates, whilst 60,000 tons of paper were even now being wasted. Waste tins should not, he urged, be burnt, but adopted for re-use on the method suggested by the National Salvage Department. Organic refuse, too, it had been proved, could be profitably used after conversion by certain digester plants. Considerable capital had been spent in the past, he pointed out, in the erection of plants for the destruction of refuse, but local authorities were finding that they could now do much better by spending money on machinery to salve it. The conference, it was recognized by all who attended, was a signally successful one, and it should serve to stimulate authorities to increased salvage activity, not only on national but also on financial grounds, for the more efficiently a local authority undertakes waste utilization the greater is the revenue obtained for a reduction in the rates.—Municipal Engineering and Sanitary Record.

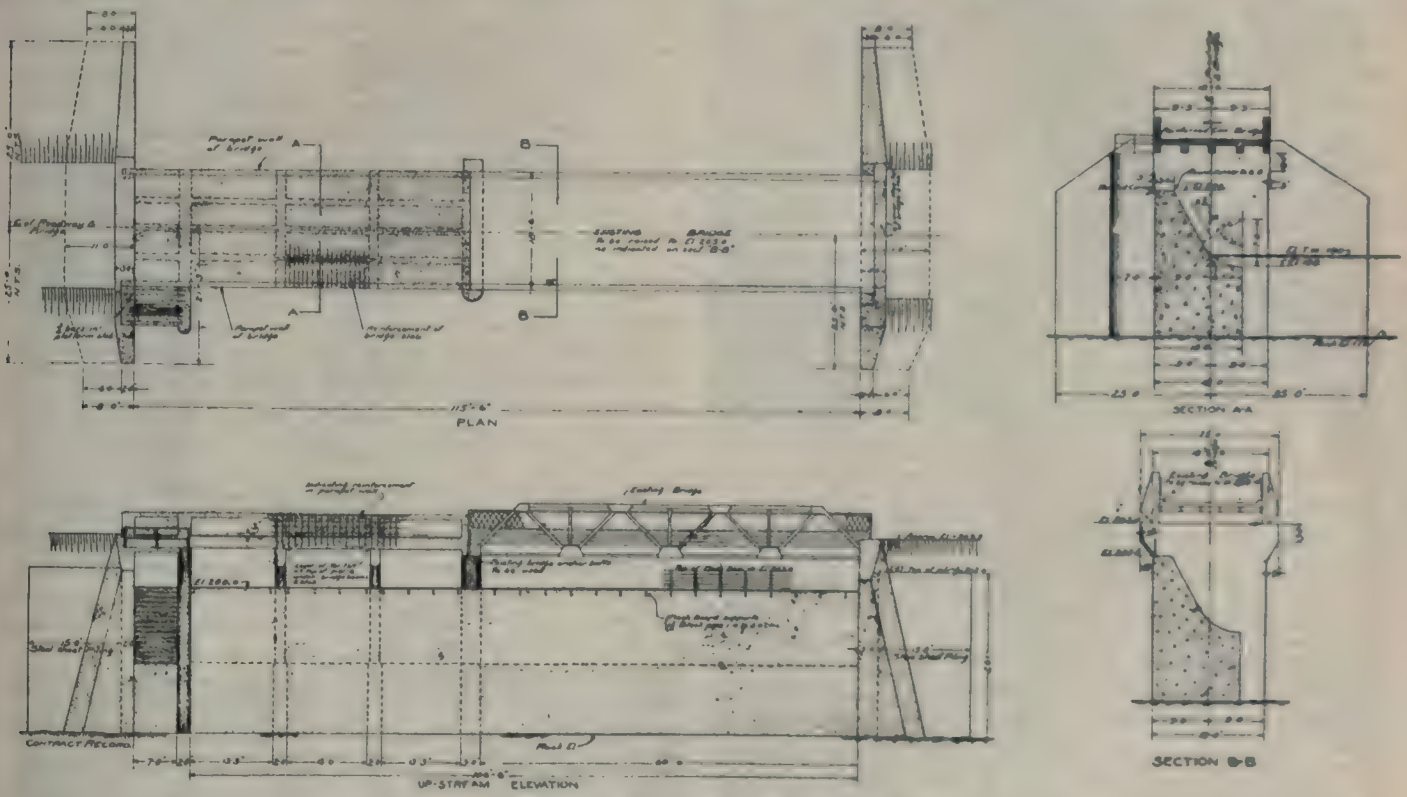
In a wooden shipyard of the Northwest, where 3000 men are working on rush schedule, it is important to impress on them the danger of breaking the rule which absolutely prohibits smoking. This is accomplished by a sign placed just inside the workmen's entrance, which reads, in large flaming letters: FIRE in this plant may put every man out of work. Help the management protect your job. NO SMOKING!

New Concrete Dam at Port Dover, Ont.

A MASS concrete dam is being constructed on the Lynn River at Port Dover, Ont., for Penman's, Limited. Plans and specifications have been prepared by T. Pringle & Son, Limited, of Montreal and Toronto, and the contract is being carried out by the Foundation Co., Limited, of Montreal.

The failure of the existing concrete dam necessitated a totally new structure. The steel roadway bridge over the existing dam is to be moved to one side during the construction of the new dam and the concrete slab forming the bridge floor is to be broken up and the strigers removed to facilitiate moving. This bridge will be put back in place when the work on the new dam is completed.

The old abutments of the dam will be removed and the new abutments carried much further apart. This will increase the length of the dam and the additional length will be spanned by a new reinforced concrete bridge, as shown in the illustration. The new concrete abutment walls at each end of the dam will be connected into the earth embankments by steel sheet pile cut-offs. A sluice way is provided at one end of the dam.



Plan, elevation and cross section Port Dover dam.

The abutment walls and dam are to be carried down to bed rock at El. 177, which is about 13 ft. below the level of the water in Lake Erie. The dam is to be built in sections and each section will be concreted from bottom to top in one operation. Flash boards, as indicated in the drawings, have been provided for. A coffer dam has been constructed of sheet piling spaced a few feet apart and carried down to rock. The space between the piling is filled with earth and the upstream side of the coffer dam is backed up with earth, etc., forming a very satisfactory dam in maintaining a sufficient head for the power house during construction.

The aggregate, for mass concrete will be in the proportion of 1:2½:5, and for reinforced concrete, 1:2:4. Approved pit gravel may be used and the work is expected to be completed by winter.

A Floor Test

DURING the wrecking of a large number of Chicago buildings to make way for Chicago's new Union Station, an opportunity was afforded to test, to the point of destruction, the floor of a modern reinforced concrete structure.

This was the first instance we know of where such test has been made on a building which had not been especially constructed for a test and which had been in service for a number of years.

The floor was loaded with load of a million and a quarter pounds of pig iron. Gauge lines on steel and on concrete and deflection points to the number of 200 were arranged. The gauge lines were selected with a view to getting information on the strains in the steel and concrete at critical places and to learn the action of the flat slab under heavy load.

The floor was a flat slab designed for a live load of 250 lbs. per square foot and pebble aggregate was used in the concrete.

The test load was applied in increments of about 200 lbs. per square foot, until a weight of 910 lbs. per square foot had been reached, the time between the first and last loads covering a period of twelve days.

After each increment of pig iron had been put in place, measurements were made on the gauge lines, and other measurements were taken each day.

Bars of steel taken from the floor in different parts of the building gave a yield of 65,000 pounds per square inch and an ultimate strength in the neighborhood of 100,000 pounds, indicating high carbon steel. Judging from its performance, much of the concrete had, during the eight years life of the building, reached its full ultimate strength. The maximum deformation was 1.1 inches.

The value of these tests consisted not merely in showing the strength of the floors, but also in showing the stresses were distributed throughout the floor and what proportions of the load were taken by the various bar systems. The fact that the floor did not fail under a load about four times as great as that for which it was designed, shows that the construction was good. Although incipient failure resulted, it was estimated that a load of 1,500 lbs. per square foot would have been necessary to produce complete failure.

It is interesting to note that the highest stresses occurred around the column caps and not at the centre of the panel. The negative bending moment was responsible for the incipient failure of the concrete around the column caps.

The test was conducted by Prof. A. N. Talbot of the University of Illinois.

British Science in Industry

The British Science Guild has opened an exhibition at King's College, Strand, London, of British Scientific Products. The exhibition was arranged by Professor R. A. Gregory, who delivered an address on its aims and objects: It had been popularly assumed, he said, that orignal scientific work was almost a prerogative of Germany, whereas a slight acquaintance with scientific history would show that most modern industries had originated with British science and invention. In purely scientific and initiative research we had been the pioneers. Where we had been deficient was in the practical use of the results obtained and the application of our natural scientific genius to the solution of industrial problems. He mentioned the work done by Sir Herbert Jackson, Professor of Chemistry in King's College, to provide the chemical glass and optical glass urgently needed when supplies from Germany and Austria were cut off. Working with a committee of the Institute of Chemistry, Sir Herbert Jackson determined the composition of numerous glasses required, and placed the formulae freely at the disposal of manufacturers. The result was a re-awakening of the glass industry in this country; and a position had now been secured which was strong enough to enable our manufacturers to meet all assaults upon it. The pure potash required for certain glasses was now obtained by a new electrolytic process, and we need never again go to Germany for it or for the glass itself. Our chemical manufacturers were meeting all demands for such synthetic organic drugs as salicylic acid and aspirin, phenacetin, and salvarsan, photographic chemicals, synthetic dyes, and associated products, as well as hundreds of similar substances of which Germany had had the monopoly. The magneto industry had established itself in a sound position, and the German instrument had been displaced for good. Hard porcelain for electrical fittings and laboratory ware was now British-made, thanks to scientific work and industrial enterprise. We produced all the tungsten required for special steels and metallic filament lamps, and could supply the world if necessary; we made aluminum alloys superior to any of the German pre-war products, and like success had been attained in other directions.

The exhibition is arranged in 14 sections. A variety of physical apparatus used in works laboratories and for teaching purposes is on view, as are also a number of electrical appliances. The textile industry is also well represented. There is one section devoted to gas traction. In this the most striking object is a standard London omnibus—with the body removed—which has been approved by the Gas Traction Committee, and will shortly be seen on the streets.

Upstairs we find beautiful tulle voile and very artistic Balek fabrics, with silks from Bradford and Macclesfield, glass from the Derby Crown Glass Company and British Glass Manufacturers' Association, and the Solway Dye Company, replacing dyes which Germany had captured. A very interesting feature of the exhibition to architects and builders will be the artificial seasoning of timber. By this process, without injury to the timber, the normal atmospheric work of a year is accomplished in less than a month. Near this the City of Bradford Technical College shows comparisons of British and German methods of worsted and yarn manipulation; and here, too, the work of recovering the aniline dyes industry is immensely important. Monazite sand, which appears in the section of Zeimar gas mantles, is another material, which though coming from British possessions, was, before the war, entirely controlled by Germany. That is altered now. It used to be said that wars were won on the playing fields of Eton, but, as Professor Keith said, speaking at the exhibition on Tuesday, in future they will be won in the laboratories of the country.

Handy Way of Screening Sand or Gravel

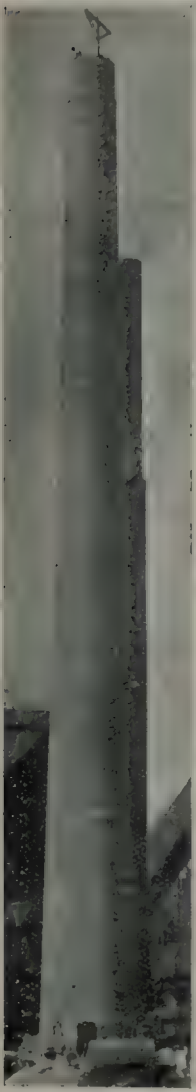
Almost every building job requires screened sand or gravel somewhere. My observation is that there are both awkward and convenient ways of doing this screening. The method my mason uses seems to me to be unusually convenient. For the convenience of those who may be interested I will describe his method in detail.

The first thing he does is to secure four pieces of 2x4's three feet long. These he stands vertically as corner posts about an area 4x3 feet. Next he secures the posts in their position by encircling the bottom and the top with a belt brace of 1x6 inch stuff. Over the bottom braces he lays a loose floor of shiplap, preferably running the pieces the short way. These are very lightly nailed so that they may be taken apart without injury to the lumber.

For a sieve he nails together a frame of 2x6-inch stuff, making a box frame 3x2 feet. Sand screen is then tacked securely to this frame. A roller of gas pipe completes the equipment.

In sieving he fills the above described sieve with sand and then rolls the same to and fro on the gas pipe roller. As the top belt braces make a good track for the roller the labor of sieving is slight.—E. L. in National Builder.

Algoma Steel Corporation Coke Plant



Hollow tile stack.

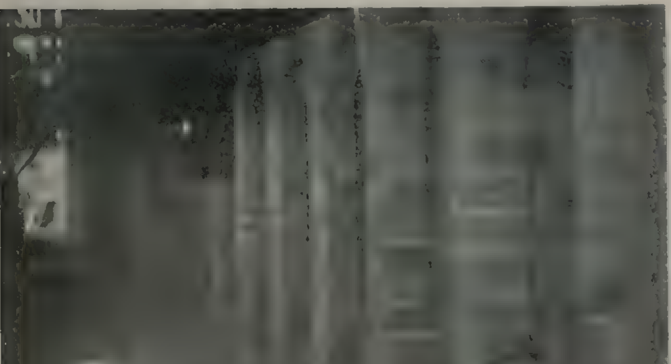
THE Algoma Steel Corporation's battery of 25 Wilputte Coke Ovens, (No. 3 Battery), commenced last November is now practically completed and work has commenced on a further 25 ovens making fifty new ovens in all. The second extension is scheduled for operation in December of this year.

The fifty new ovens operated on an 18 hour coking time will give about 650 tons additional coke daily, which, with the 1150 tons daily from the present plant of 110 Koppers Ovens, designed for a 22 hour coking time, will give a total daily output of Furnace Coke of 1800 tons.

The above installation when completed will provide sufficient coke for the Blast Furnace Plant which has been recently increased by the addition of a new 400 ton Furnace blown in last May.

The old No. 1 and No. 2 batteries, built in 1910, are of particular interest as being the second installation on this continent of Coke Ovens with vertical flues and separate regenerators, the first being at Joliet, Ill.

The Wilputte Ovens now being erected embody the many improvements that have been found to be of practical utility, during eight years of great development in the By-Product Coke Industry, the changes effected having for their aim faster coking time, with a maximum production of coke suitable for Blast Furnace purposes and a maximum recovery of by-products. It is claim- for the Wilputte Oven that in the arrangement of the regenerators, by the use of a positive air feed and adjustment of the air supply to give the exact proportion of air and gas required for complete combustion at different parts of the oven wall and in the form of the cover brick at the point where the vertical flues enter the main horizontal flue, the regulation of the heats is greatly facilitated.



View of oven regenerators nearing completion.

A feature of the construction is that the new batteries are being erected on concrete piles of the MacArthur type. A considerable saving in depth of concrete required for the foundations has been effected in the use of these piles as the foundations of these batteries situated, as they are, close to the shore of the St. Mary's River, are subject to the effects of the constantly changing level of Lake Superior and hence it wood piles were used would have to be carried down to a point below the minimum lake level. The work of driving the piles for the first 25 ovens was carried out successfully during the severest part of an unusually severe winter, the gravel and water, of course, being heated. The ground in which they were driven consists of mixed fill, in which there was a considerable amount of broken brick and pieces of timber. The piles were driven through this without difficulty, except in one instance where a large block of timber had to be cut. Four piles were chosen after the break-up and a loading test applied with satisfactory results. The weight of pig iron used in the test was 120 tons, and the maximum settlement which resulted was 5/16 in. The piles are spaced to give a maximum load of between 20 and 25 tons per pile.

McArthur piles excavated to level of waste heat flue preparatory to being cut off to level of bottom of concrete.

It is indeed a tantalizing thing to remove a screw from which one-half the head has broken off. The following method overcomes this difficulty and incidentally aids materially in conserving one's temper: Drive a large nail—a 40 or 60 penney—by the side of the broken screw. Pull the nail with the hammer. It is then an easy matter with the same nail or the screw-driver to pry the screw over into the hole made by the nail.

The Chemistry of Concrete Disintegration

THE chemical composition of concrete is a closed book to the vast majority of those who handle it, often with good success. There are various grades of concrete, however, probably as many as the number of contractors who use it, and there can be little doubt that the best results can never be consistently attained until the chemical processes accompanying the setting of concrete are thoroughly understood. Much progress has been made in recent years in our knowledge of concrete, and an interesting article reviewing the situation was recently presented by Mr. A. Blackie, before the Engineering Institute of Canada. The paper follows:—

The disintegration of concrete is due to the presence of the so called alkali salts in the soil and to the presence of ground water which dissolves these salts and carries them into the concrete. The so-called alkali salts that occur in the soil in this district are sulphate of sodium, magnesium and calcium; these salts are also found in the ground waters. The salts are found in deposits and I think are generally found only near the surface.

Chemical analyses of disintegrated concrete show that the disintegrated portion contains a much higher percentage of sulphate than the original materials used in the concrete, and also that the disintegrated mass is impregnated with minute crystals of calcium sulphate; these crystals are found in great quantities in the disintegrated material, and gradually become fewer as the portion of the concrete unacted upon is approached.

The solubilities of the above sulphates in cold water are in the following proportions:

$MgSO_4$, 30 parts in 100 parts cold water.
Na_2SO_4, 4.3 parts in 100 parts cold water.
$CaSO_4$, 0.18 parts in 100 parts cold water.

As might be expected from their solubilities the deposits usually contain more calcium sulphate than Mg or Na sulphates.

Sulphates Principal Cause of Trouble.

With regard to the solubilities another point that has to be remembered is that whilst the solubility of $CaSO_4$ is low in distilled water, the solubility is about doubled in a solution of salt or NaCl, and also that all our ground waters in this district, contain more or less salt, in some instances being so brackish as to be unpalatable. Research into the chemical action of alkali in cement has been carried out for some years by different experiment stations in the United States, and all are agreed that the sulphates are the principal causes of the trouble. Just how they react with the concrete is disputed.

Bulletin 81 of the Montana Experiment Station, published in February, 1911, advances the theory that disintegration is due to the formation of compounds which have a greater molecular volume than that of the compounds in cement which are acted upon by the solutions, these cause expansion and subsequent cracking.

Another theory put forward is the formation of tricalcium sulpho-aluminate, this compound causing cracking and subsequent disintegration. Technologic Paper No. 95, issued by the Bureau of Standards, in 1917, proves that this compound cannot be formed, but the authors of this bulletin do not commit themselves to any definite theory and summarize their work as far as it has gone with the following conclusion:

> "No definite conclusions can yet be drawn as to the ultimate resistance of concrete to the action of alkali in the soils and waters of the projects. However, the complete failures found at the Belle Fourche project, where local materials were used, together with the action which has commenced on the surfaces of many of the blocks on other projects, indicates that materials of good quality and proper workmanship are of greatest importance.
>
> Concrete which is to be placed in alkali soils should be made of selected and tested materials, so proportioned as to produce a dense concrete. As small an amount of mixing water should be used as will allow the mass to be properly placed. Unless these precautions are taken the resistance of the concrete to alkali will be reduced."

Draintile.

On page 93 of Technologic Paper No. 95 Bureau of Standards, the following conclusions are drawn regarding the use of cement draintile exposed to soils and water containing alkali salts in quantities of 0.1 per cent or more:

1. The use of cement tile in soils containing alkali salts in large quantities is experimental.
2. Porous tile, due to the use of lean mixtures or relatively dry consistence, are subject to disintegration.
3. Some dense tile are, under certain conditions, subject to surface disintegration.
4. Disintegration is manifest by physical disruption, caused by the expansion resulting from the crystallization of salts in the pores and by softening, resulting from chemical action of the solutions with the constituents of cement.
5. While results obtained will not permit of a definite statement as to the relative effect of the various constituents of the salts, indications are that the greater the quantity of sulphate and magnesium present and the greater the total concentration of salts the greater will be the disintegrating effect.
6. Tile made by the process commonly used, which allows the removal of forms immediately after casting, are subject to disintegration where exposed to soils or waters containing one-tenth per cent. or more alkali salts similar in composition to those encountered in this investigation..
7. The hand-tamped tile of plastic consistency, as made in this investigation, are not equal in quality to machine-made tile of the same mixture, and they do not resist alkali action as well.
8. Steam-cured tile show no greater resistance to alkali action than tile which are cured by systematic sprinkling with water.
9. Tile made of sand cement have less resistance to alkali action than tile made of Portland cement of the same proportions.
10. The tar coating, as used, is not effective in preventing the absorption of alkali salts from the soil.
11. The cement-grout coating is not effective in preventing the absorption of alkali salts from the soil.
12. No advantage is found in introducing ferrous sulfate into the cement mixture.

If cement draintile are to be used in alkali soils or waters containing 0.1 per cent or more of salts, similar in composition to those encountered in this investigation, they should be made of good quality aggregate in proportions of not less than 1 part portland cement to 3 parts aggregate. The consistency should preferably be quaking, which has proved the most resistent of all mixtures used. (See description of tile series 2). This is wetter than that generally used in commercial tile plants and will probably require the retention of the tile in the molds for several hours, unless some means are found to hasten the hardening of the cement.

No Disintegration After 30 Years.

In contrast to this we have here for exhibition a piece of draintile taken from the ground beside the Grain Exchange footings, where it has been exposed to the ground waters for 30 years. The concrete is perfectly sound and shows no sign of disintegration. Unfortunately details of the mixture used in the manufacture of this pipe are not available.

The University of Wyoming Agricultural Experiment Station, Bulletin No. 113, published in March, 1917, summarizes the results of their work with the following conclusions:

1. Cement put into solutions of alkali sets as well as in water.
2. In solutions of sodium sulphate $CaSO_4\,2H_2O$ is formed.
3. In solution of magnesium sulphate $CaSO_4\,2H_2O$ and $Mg(OH)_2$ are formed.
4. In solution of sodium chloride a silicate is formed. The high percentage of sodium in this silicate is likely the reason for the increase of insoluble sodium in the cement.
5. Sodium chloride in solution or its presence in solution with other alkali salts, has its effect chiefly through a solvent action.
6. Of the solutions tested the 5 per cent sodium sulphate had the greatest disintegrating effect.
7. Solutions containing (mixed) chlorides, sulphates and carbonates had the least effect.
8. Mortars disintegrate faster than neat cement.
9. The formation of compounds of greater molecular volume than the volume of calcium hydroxide is not the cause of the disintegration of cement.
10. The ultimate cause of the disintegration of cement is due to the alkalis forming compounds with the elements of cement, which are subsequently removed from the cement by solution.

The Ground Water Must be Taken Care of.

The conclusions drawn in all these summaries are more or less supported by experimental work and yet they are to some extent contradictory. This shows the necessity of further work and research on the question. However, the final paragraph of Bulletin 113 from the University of Wyoming, summarizes the whole situation, that is, that ground water must be taken care of. The writer's first experience of the disintegration of concrete occurred when some years ago in Winnipeg it was reported that one of the large concrete sewers of the city was being destroyed by sewage. With the City Engineer a careful investigation was made consisted of limestone sand and cement. Al-the disintegration occurred high up in the sewer, and that there was no evidence of disintegration at or near the water level. The disintegrated concrete was soft and of putty-like consistency.

An analysis of a sample of disintegrated concrete from this sewer showed the sulphate content to be 2.54 per cent. The concrete from which the sewer was made consisted of limestone sand and cement. Although we have no analysis of these materials it may be assumed that with the exception of the cement the concrete materials would not contain any sulphate. If we assume that the cement used contained 2% SO_3, (the standard specifications require that Portland cement shall not contain more than 1.75% SO_3), and that the concrete was mixed in proportions 1 part cement to 7 parts of aggregate, then the SO_3 in the concrete would be 0.25 per cent., yet the analysis shows SO_3 content 2.54 per cent.

Samples of concrete from four other sewers where disintegrated concrete was found showed SO_3 content 5.02 per cent., 5.03 per cent., 2.35 per cent. and 5.90 per cent. These percentages are all very much higher than could be reasonably expected and confirm the results of laboratory experiments which show that solutions containing magnesium and sodium sulphate react with the cement and also the limestone.

From various minor laboratory experiments carried out by the writer at different times a conclusion was reached that some interesting information might be obtained and some light thrown upon the disintegration of the concrete by determining the action of the various alkali solutions upon the sands used locally in the composition of concrete. Accordingly some tests were made using a sand known locally as Birds Hill sand, and having the following composition:

Silica (SO_2)	47.54%
Iron and Alumina (Fe_2O_3&Al_2O_3)	28.32
Loss on ignition	19.32
Calcium (Ca)	3.71
Magnesium (Mg)	0.57
	99.46%

It was found that .009 per cent was soluble in water and of this .0012 per cent existed as water soluble sulphates, stated as SO_3. The sand was then extracted with the following solutions:

1. 10% magnesium sulphate.
2. 5% calcium sulphate plus 10% sodium chloride.

Solvent Effect Upon Lime in the Sand.

These experiments showed that to some extent these alkaline solutions had a solvent effect upon the lime in the sand. These tests were not brought to a definite conclusion and further investigation is necessary along this line.

Some further tests were then made on briquettes made with cement and limestone in proportions of 1 to 3 by weight. The limestone was graded so that its grains would be the same size as those of standard Ottawa sand. These briquettes were placed in the following solutions:

5% magnesium sulphate,
10% sodium sulphate,
5% calcium sulphate plus 5% sodium chloride

And also in a solution made from white soil deposit having the composition:

Calcium sulphate	62.5
Magnesium sulphate	37.5

These briquettes showed rapid deterioration by softening of the edges, reduction in tensile strength, and also by the solution becoming turbid.

In previous experiments some indication had been given that mortar coming into contact with the alkali ground water before it had thoroughly hardened would disintegrate rapidly. With this in mind a series of tests were made in conjunction with the officials of the Greater Winnipeg Water District.

Four sands were selected for these tests differing both in grading and chemical composition. A large number of briquettes were made from these sands for 1 to 2 and 1 to 3 mortars. A set of neat cement briquettes were also made for comparison.

For each mortar 40 briquettes were made and cured 24 hours in a moist closet. 20 of these were then placed in the following solutions:

(1) Distilled water; (2) tap water; (3) 10 per cent magnesium sulphate; (4) 10 per cent sodium sulphate.

The remaining 20 briquettes were steamed by being placed on a rack over water in a copper boiler such as is used for testing cement pats. The temperature was maintained as nearly as possible at 150°F. After 48 hrs. steaming the briquettes were placed in solutions corresponding to those used for the unsteamed sets. From the five briquettes in each of the sulphate solutions two were removed and kept in air for 24 hours and then replaced in solution 24 hours. This treatment was continued throughout the test which was for a period of 3½ months. Some of the briquettes disintegrated and some remained firm. In general 1 to 2 mortars withstood the action of the sulphates better than the 1 to 3 mortars and the unsteamed briquettes better than the steamed. Some of the latter were so badly swollen and disintegrated that it was thought advisable not to break them but to keep them for exhibition. In order to throw some light on the cause of the failure of some of the mortars to resist the action of the sulphates some density tests were made on the various mortars used in these briquettes.

Mortar with Lowest Density Disintegrated First.

On comparing the figures obtained for density with the resistance of the mortars to the alkali solutions it was observed that in general for a given cement content the mortar with the lowest density disintegrated first.

In the case of standard Ottawa sand 1 to 3 mortar there is insufficient cement paste present to fill the voids in the sand. These briquettes disintegrated very badly. The neat cement specimens were practically unacted upon. One of the mortars on removal from the sulphate solutions showed a strength after 3½ months of 600 lbs. whereas the strength of same mortar in distilled water for same time was 360 lbs. Mr. Blackie advances the explanation that the calcium sulphate formed in the briquette is itself very strong, and has added to the strength of the briquette, but that in presence of plenty of water the sulphates would gradually be dissolved out and the briquettes would disintegrate.

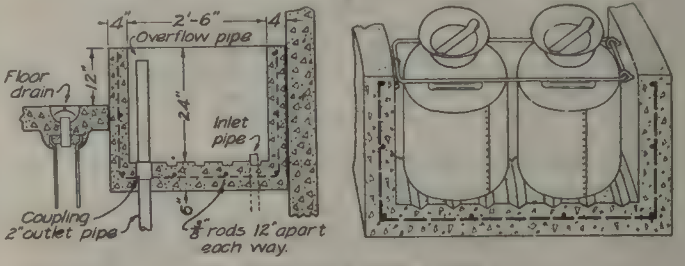
To summarize the results of these experiments. As far as they have gone they seem to indicate that the action of the sulphates on mortar is proportional to the porosity of the mortar. In view of the fact that comparatively little time has been available to go into this matter thoroughly the results of these tests should only be taken as pointing to a line of further investigation which should yield most interesting results.

Simple Design for Concrete Milk House

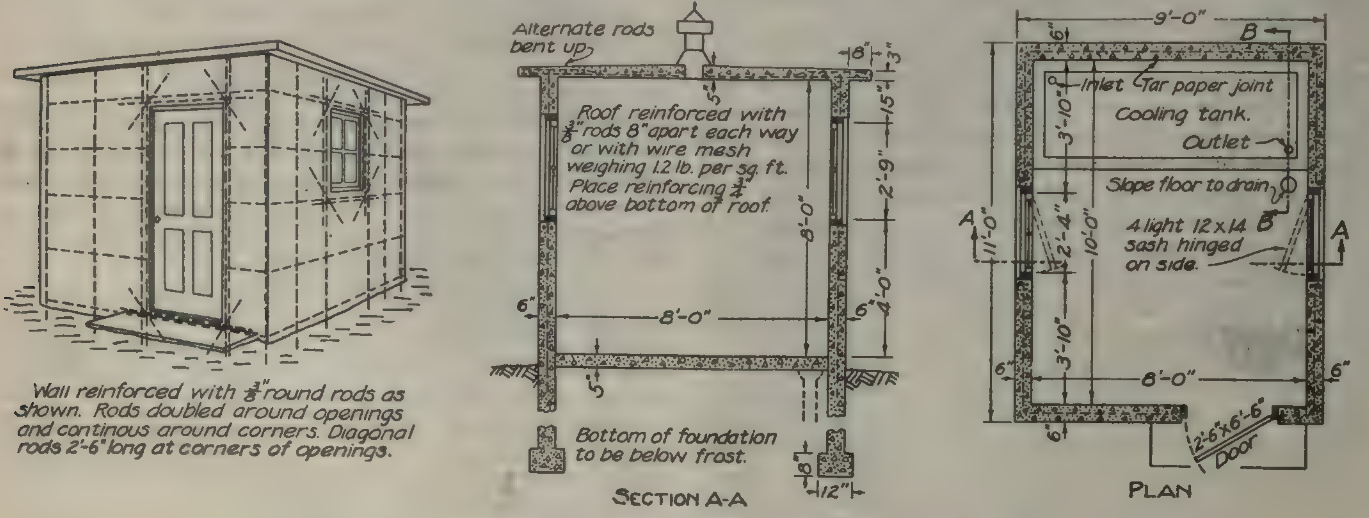
CONCRETE lends itself admirably to the construction of a milk house. Here absolute cleanliness must be maintained for obvious reasons. Concrete is, generally speaking, a non-obsorbent and does not take, nor retain, odors. In concrete construction the walls, floors, etc., are free from cracks or ledges where dust or dirt might collect. The surface may be washed down as frequently as necessary and if desired it may be sterilized. Concrete is easy to clean and easy to keep clean. It is fireproof, rat-proof and damp-proof, and its upkeep or repair is practically nil.

The milk house should be located convenient to the barn, but not so near it, or the barn yard, that it will be exposed to odors from these places. It should also be near, or convenient to, the water supply. A location between the house and barn, yet near the well or other source of water is preferred in the majority of cases.

A simple and inexpensive plan of milk house is shown in the illustrations. The house is a small one and is purposely designed so as to provide no spare room to encourage the use of it as a place of storage.



Sections through Cooling Tank.


Wall reinforced with $\frac{3}{8}$" round rods as shown. Rods doubled around openings and continous around corners. Diagonal rods 2'-6" long at corners of openings.

Alternate rods bent up
8"
3"
5"
15"
Roof reinforced with $\frac{3}{8}$" rods 8" apart each way or with wire mesh weighing 1.2 lb. per sq. ft. Place reinforcing $\frac{3}{4}$" above bottom of roof.
2'-9"
8'-0"
4'-0"
6"
8'-0"
6"
5"
Bottom of foundation to be below frost.
8"
12"
SECTION A-A
9'-0"
6"
B
Inlet
Tar paper joint
Cooling tank.
Outlet
3'-10"
Slope floor to drain
B
A
11'-0"
2'-4"
10'-0"
4 light 12 x 14 sash hinged on side.
A
3'-10"
6"
8'-0"
6"
6"
2'-6"x6'-6" Door
PLAN

Perspective view, plan and section of Milk House.

The plan shown is rectangular in form and provides for a concrete milk cooling tank at one end. The milk cans should stand in cold water as deep as possible so the size of the milk cans will determine the depth of the cooling tank as well as the length of the overflow pipe; in any event, the water should come well up on the necks of the cans.

Running spring water will keep milk at a temperature of 55 degs., or even lower, so if this is available, ice will not be necessary; otherwise ice should be used and provision should be made for a regular supply of ice on the farm. The water should enter the tank at floor level and the outlet pipe should be provided at the other end, as shown in the drawing. This arrangement will give a good circulation and insure a regular change of water.

The floor of the cooling tank should be designed with grooves in the concrete to enable the water to circulate under the cans. The illustration shows a device to hold down the cans when they are not heavy enough to settles under their own weight. This device will also prevent the cans from overturning and either spilling the milk or allowing water to enter the cans.

The materials required for the construction are as follows:—Cement, 15½ barrels; sand, 5 2/3 cu. yds.; ¾ in. broken stone, 9 cu. yds.; reinforcing steel, 975 ft., ⅜-in. diameter, round rods.

The mixture recommended is: For foundation, 1:3:5; walls above ground, 1:2½:4; roof, tank and floor, 1:2:3.

Good Roads Day at Ottawa Exhibition

"GOOD ROADS" day was a feature of the Ottawa exhibition this year. It was arranged mainly through the instrumentality of the Eastern Ontario Good Roads Association, and its success was well merited by the efforts and enthusiasm of the members. The occasion was marked by the presence of Premier Hearst and several members of the provincial government, including Hon. T. W. McGarry, provincial treasurer, Hon. G. Howard Ferguson, minister of lands, forests and mines, and Hon. R. F. Preston, minister without portfolio; also Hon. Edward Duffy, highway commissioner for New York State.

A "Good Roads" lucheon was held, at which Mayor Fisher presided, and the Premier and his colleagues, and Hon. Mr. Duffy spoke. Mr. Duffy pointed out that the State of New York had built 8,000 miles of state roads and, with auxiliary highways, was maintaining 17,000 miles, and he remarked that a proposition could be put through in a rural township to improve a roadway wholly at the expense of the municipality, more easily than any taxation project could be put across because the people knew that roads yield return and aid and promote commerce.

In the evening a large deputation of the Eastern Ontario Good Roads Association gathered to hear Sir William Hearst and the other members of the government speak on the "good roads" question, and also to present a petition dealing with the situation in their own part of the province. The main point in this petition, which was signed by between 7,000 and 8,000 people, was the request that the roads from Morrisburg to Ottawa, from Pointe Fortune to Ottawa and from Pembroke to Ottawa, be designated as provincial highways. In regard to this request, the Premier said he did not think there was any doubt that these roads would be proclaimed as provincial highways. He also stated that his government was fully and absolutely committed to a system of good roads for the province and that it meant to maintain that attitude until all is accomplished so far as is possible, but pointed out that the winning of the war was the first consideration. The other members of the government who were present, also addressed the delegation.

Ald. Wm. Findlay, president of the association, thanked Sir William Hearst and his colleagues for favoring them with their presence. Proceeding to outline their aims and organization, he said, "Our association and its work embraces eleven eastern counties of the province from the city of Kingston to the Ottawa river. It was organized only in July; it has a membership of considerably more than 200, and so great is the interest in its work that many of the municipalities in this section of the province are willingly and cheerfully contributing to our funds. We exist primarily for the purpose of stirring up enthusiasm and interest in good roads, and also for the purpose of attempting to correlate the efforts of the various counties and communities in the building and maintenance of their roads, so that we may have in Eastern Ontario a connected and continuous system of good highways." Ald. Findlay also stated that "it is a conviction which our members, our directors and our executive committee desire to maintain, that so far as leading roads are concerned, that is, the thoroughfares that cross more than one county and that lead from one centre of population to another, these roads should be province-built, province-owned and province-maintained."

Cutting Circles on Band Scroll Saw.

A certain woodworking plant recently received a large order for caping stock, cut from ¼-inch stock into 17-inch circles. At first the circle was marked with pencil from pattern onto the stock to be cut. This, however, proved so slow and expensive in operation that the following simple device was constructed on the band scroll saw table, which does away with the marking off of the circles and increases the speed of the operation more than double the amount of production over the former method.

A board 20 inches square was secured, onto which a swivel stop was attached. A sharp pointed nail was driven exactly 8½ inches from the edge next to the saw blade from the bottom side, thru, so that point projected just about ⅛ or 3/16 inch through surface of board. This was next nailed onto saw table with four small nails, after being adjusted to measure 8½ inches from center of nail projection to edge of saw. The stock was next run up lightly to saw and then pressed onto center nail and turned around. The saw then cut a more accurate circle than was possible to obtain by first marking off, and this in less than half the time required by the former method.—R. M. in National Builder.

Loosening Rusty Wood Screws

Wood screws that have become so badly rusted that they cannot be moved by ordinary means may be loosened by heating them. This may be done by applying a hot soldering iron or poker to the heads. The expansion and contraction caused by the application of the hot iron and its subsequent withdrawal will usually loosen them enough so they may be removed with a screwdriver.

Design and Operation of Sewage Treatment Plants

By H. A Whittaker*

BEFORE designing a treatment plant, a careful study should be made to determine the volume and character of sewage to be treated. When the sewers are already in use, actual measurements of the sewage flow should be made, covering a considerable period. A census of the actual number of sewer connections should be taken and a record made of the character and amount of sewage discharged from manufacturing plants, such as creameries, tanneries, gas plants, etc. The ground water flow should be measured or carefully estimated. The plant should be designed in accordance with the above data and with reasonable allowance for future growth.

Where a new sewerage system is to be constructed, care should be taken to obtain good grades, whenever possible. Flush tanks should be installed wherever the grade of the sewer is such that it will not be self-cleansing at all times. The sewage system should be so designed that the sewage will be delivered to the treatment plant in as fresh a condition as possible.

For small plants, where the sewerage system is of the separate type, removing house sewage only, grit and screen chambers may often be omitted to advantage. Grit and screen chambers are necessary where the sewerage system is of the combined type, and, when used, these chambers should be made easily accessible for cleaning.

Imhoff Tanks.

The settling chambers should be designed to hold the average flow of sewage for a period of two hours. The sloping walls of the settling chamber should be constructed as steep as possible; never less than 1.2 vertical to 1.0 horizontal, and, better still, 1.5 vertical to 1.0 horizontal. The walls should be smooth, with no projections. A baffle should be installed at the inlet and a scum board at the outlet. These should be located approximately 1 to 2 ft. from the inlet and outlet ends of the tank, respectively. They should extend across the tank and to a depth of about 12 in. below the surface of the sewage. The invert of the inlet pipe or pipes should be at an elevation of a few inches above the surface of the sewage. The inlets and outlets should be so located as to distribute the flow as much as possible across the entire section of the settling chamber. Outlet weirs should be relatively narrow. Very wide weirs are not desirable since it is difficult to keep them clean.

The sludge compartment should be of generous size. For Minnesota conditions, where the winters are long and severe, a part of the sludge must remain in the tank for nearly a year. It is the opinion of the Division of Sanitation of the Minnesota State Board of Health that sludge compartments should have a capacity of at least 2 cu. ft. per capita. In computing the size of the sludge compartment, only that portion should be considered that is below a horizontal plane 2 ft. below the slot or slots in the bottom of the settling chamber. The sludge will not flow a great distance horizontally to the sludge removal pipe. In large tanks, two or more sludge removal pipes should be provided.

Tanks should be uncovered. Light, easily handled, wooden covers should be provided for winter use. The entire plant should be surrounded by a tight, high ornamental fence, to keep out animals and unauthorized persons.

The operation of a sewage treatment plant is a very important feature and one which is seldom given sufficient attention. A poorly designed plant under conscientious management will often produce better results than a well designed plant with indifferent management. Plants should be constructed so that all parts are easily accessible to the operator. It is frequently necessary to break up the scum which will collect on the sewage in the vents and to scrape down the walls of the settling chamber and push through the slots material which will adhere to the walls. Readings should be taken frequently to determine the surface of the sludge in the sludge chamber so as to know when and how much to remove. The sludge should be examined occasionally to determine whether or not it is acid or alkaline. An acid sludge is sour and foul-smelling and generally requires a long period for drying. Such a sludge should be treated with lime.

The operator should be provided with necessary tools and apparatus to care for his plant. The tools usually consist of a sludge scraper, used for the purpose of scraping down the walls of the settling chamber; a scum breaker, used for the purpose of breaking up the scum which may collect on the surface of the sewage in the vents; a skimmer, used for the purpose of removing to the vents scum which sometimes collects on the sewage in the settling chamber; and a sludge sampling apparatus, in order to determine the position of the surface of the sludge, and a set of Imhoff tubes with which the operator can detemine roughly how the plant is operating. Each plant should be provided with a house of generous size in which the tools can be kept and in which the necessary analytical work can be performed.

Pumping Machinery.

Where it is necessary to pump the sewage or the sludge by pumps driven by electric motors, the motors, switch boards, or starting rheostats should be located. in a building not directly connected with any part of the sewage tratment plant, since the condensation and moisture in the winter months is very heavy on all parts of the plant directly connected with the settling or vent chambers.

Sludge-Drying Beds.

Sludge-drying beds should be located as close as possible to the Imhoff tank. Where it is necessary to conduct the sludge a distance of 10 or 15 ft. horizontally to the drying bed, it should be allowed to flow in open channels rather than in pipes, since long sludge pipes are likely to become clogged with dried sludge. Where the sludge is removed from the tank by gravity, the sludge pipe outlet should be at an elevation at least 6 ft. below the sewage in the tank. The sludge should be discharged on to the bed from an elevation at least 2 ft. above the surface of the bed so that the sludge removal pipe can be drained after each removal of sludge. The sludge drying beds should be of generous size, having an area of not less than 1 sq. ft. per capita.

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*Director of Sanitation, from a report to the Minnesota State Board of Health.

Percolating Filters.

Percolating filters, where necessary, should be of ample size, so as to prevent overworking. It should be remembered that in the colder climates the bacterial action in the filters is much slower than in milder climates. Therefore, to produce the same results, filters must be considerably larger than would be necessary in a southern climate. Tests have indicated that, on very hot days, percolating filters could be operated efficiently at the rate of 4,000,000 gal. per acre per day, whereas, in colder weather, only 400,000 gal. per acre per day could be applied to obtain the same results.

Resettling Tanks.

A resettling tank, having an average holding period of about one hour, shall be installed wherever percolating filters are used. This tank shall be provided with cross baffles. The bottom shall be hopper-shaped. Adequate provision for sludge removal shall be provided. The sludge-drying bed shall be constructed in a manner similar to the bed for drying the sludge from Imhoff tanks. This bed shall have a net area equal to at least ½ sq. ft. per capita.

Sand Filters.

Sand Filters have not been entirely successful under Minnesota conditions, due to freezing in cold weather. They cannot be operated at rates much exceeding 100,000 gal. per acre, per day and require a great deal of attention.

Rules for Operation of Imhoff Tanks.

Any material, other than sand and grit, which may collect in the inlet chamber, should be forced through the opening into the settling chamber. Sand and grit should be removed and deposited upon the surface of the ground. The inlet chamber should be kept clean at all times. Any material which rises to the surface of the sewage in the settling chamber which does not sink readily when broken up should be removed to the vents. Any sludge which deposits on the walls of the settling chamber should be forced through the slots into the sludge-chamber. The walls of this chamber can be kept clean by daily scraping and forcing any adhering deposit through the slots.

Any scum which collects on the surface of the sewage in the vents should be thoroughly stirred up daily, so as to liberate the entrained gases and facilitate the settling of the solid material. If the scum in the vents should reach a thickness of over 6 in., a portion of it should be removed. The surface of the sludge in the sludge chamber should never be allowed to reach a point higher than 2 ft. below the slots, equivalent to a point about 9 ft. below the surface of the sewage. The level of the sludge in the sludge chamber should be lowered about 2 ft. each time the sludge is removed, except in the late fall, when about 4 ft. should be removed to allow for the winter's accumulation. The operator should be provided with a sampling outfit by means of which bottle samples of sewage in the sludge chamber can be collected at various depths and the exact location of the surface of the sludge determined.

The surface of the sludge should be determined at least once every two weeks.

Ice which may collect on the surface of the sewage in the settling and vent chambers should be removed immediately.

When the sludge on the drying bed reaches a depth of about 1 ft., it should be removed. Since a portion of the sand will adhere to the sludge removed from the bed, it will be necessary to replace the top layer of sand on the bed from time to time.

Measuring the Mixing Water

Here's a foolish little kink which worked. When you mix a lot of concrete, you want to handle the water easily and without waste. So you connect the supply to flow into a barrel. Barrel is on the mixing platform, elevated, of course, to feed easily into the power mixer. Let the man whose duty it is to measure the water be stationed on the ground near the barrel, very near. That is important. Have the valve within reach of the man. Then measure in the barrel just the amount of water needed for each batch of concrete. Bore a hole in the side of the barrel at this level so determined, right over said man. Even though he is occupied in checking loads of stone, cement and sand, it is surprising how adept he soon becomes in gaging the time when the water is just about to spill—on him.—K. E. Hildreth, Syracuse, N. Y. in Concrete.

Screening Gravel

On one job, the layout was such that we served local gravel direct into the charging end of a small gasoline driver mixer, from the railroad car. The mix was 1:4, as the gravel was an excellent grade, coarse and uniformly graded and was dredged from a nearby river. At the same time, screened sand was required for mortar. The gravel was wet and hard to screen. There was considerable vibration from the mixer engine and our foreman conceived the idea of attaching the mixer frame to the screen by a wooden strut, making a shaking screen. It kept two men "humping" to shovel gravel into the screen fast enough to feed the mixer loader and the mortar men. The quantity of screened sand was increased materially with a reduction of the entire screening crew. It sure was a money saver and a speeder.—W. H. Scales, Danville, Ill.

Greater Efficiency Shown in Building Wooden Ships

Canada has again smashed all records for speed in wooden shipbuilding. The latest feat has lowered this country's own mark by about sixty per cent.

The War Camchin, a wooden ship of 4,100 tons, built for the Imperial Munitions Board, was launched by the Foundation Company Ship Yards at Victoria, B.C., on August 31. Installation of machinery commenced at the Imperial Munitions Board's installation plant at Victoria on September 3rd. The installation work was completed in twelve and one-half working days. On September 17th a successful sea-going trip was held. This vessel will commence loading cargo within seven days of the trial trip.

The previous record in Canada was held in Quebec.

Engineering Features of St. John Harbor Development

By Alex. Gray*

ST. JOHN Harbor is situated at the estuary of the River St. John, which is about 460 miles long, with a drainage area of 26,000 square mlies, and an average flow of about 20,000 c.f.s.

Numerous articles have been published on the tidal phenomena in the Bay of Fundy, and St. John River, but it is unnecessary to deal with these in this paper, further than in so far as they affect the engineering features of harbor development.

The river discharges into the head of the harbor, through a rock gorge about 1200 feet long and 400 feet wide. The small cross sectional area of the channel does not admit the flood as fast as it rises, or discharge the ebb as fast as it falls into the bay. The minimum summer level of the water surface of the river is 15.0 feet above low water datum of harbor and the tidal range in the harbor is 13 to 30 feet. The variation of the sea level therefore, at high water is from 2 to 14 feet higher than the river, thus forming at every tide the Reversing Falls. The extreme high water of the river during spring freshet rises from 10 to 18 ft. above the minimum. Navigation between the harbor and the river is only possible for a period of from one-half to one hour, occuring before and after high water—the time generally being about two and a half hours ebb and three and a half hours flood. At Indiantown, about one mile above the Falls, high water occurs about one hour six minutes, and low water occurs two hours twenty minutes, later than high and low water in the harbor. The average tidal rise at Indiantown, about one-half mile above the Falls, is about 1.3 feet.

The Negro Point Breakwater.

The gorge at the head of the harbor, with its merged reef, forms a slack water reach, which is navigable for small craft from St. John to Fredericton, about 84 miles, and for a total of about 90 miles on several tributaries of the river. This slack water reach acts as a settling basin, in which the heavier silt is precipitated.

The exposure of the harbor is from the southeast to the southwest. The prevailing winds are from the northwest, from which quarter the severe storms generally originate and afterwards change to the south, causing considerable inconvenience in the harbor. The height of the maximum waves during these storms is about 10 feet.

The Negro Point Breakwater, 2250 feet long, is of the rubble mound type, with stones placed at random on the outer slope, weighing 2 to 8 tons, with concrete superstructure for about 940 feet. It was originally designed with a cribwork core, commenced in the spring of 1875 and completed in September, 1877. A heavy storm, however, on the 11th and 12th February, 1879, carried away 1300 feet of the cribwork, to from 10 to 19 feet below high water. From that date to about 1887, work was annually carried on in placing stone to bring the seaboard side to a uniform slope of 3 to 1. There is now a concrete superstructure 15 feet wide for a length of 946 feet. The seaward slope at concrete superstructure is 2 to 1. The portion of breakwater, without concrete superstructure, has been raked down by storms to a slope of about 6 to 1, and the crest has been moved towards the harbor about 35 feet off centre line. Around the lighthouse, are placed concrete blocks, weighing 60 to 80 tons each; they are founded a little above low water level. Mr. Shewen, who designed these blocks and the method of construction, arranged the work so that the pouring of concrete was begun as soon as the foundation was dry, and proceeded with at such speed as to keep the top of block above the rising tide—the covering of the casing being pressed down upon a cushion of jute, stuffed with oakum, before the tide rose to the top of the block. After extreme storms, marks on the stones, the disappearance of seaweed from the surface, and the displacement of the larger stones indicate the considerable forces exerted. The concrete work in the breakwater is in first class condition and offers encouragement for concrete in salt water, providing sufficient care is exercised in mixing and placing.

Ten Berths on West Side

Observations with a marine dynamometer give the force of waves at breakwater a pressure of upwards of 4000 lbs. per square foot. Part of the concrete work and the dynamometer observations were carried out under the direction of Major E. T. P. Shewen, M. E. I. C., who was for a number of years District Engineer for the Department of Public Works.

Through the opening of about 1500 feet between the end of the breakwater and Partridge Island, heavy southerly waves break and expand, following the ragged face inside the shore, and continue to roll towards the harbor, causing such extensive erosion of the coast line that protective measures had to be taken in building a revetement wall along the foot of Fort Dufferin.

The principal development in the harbor to date has been on the west side, on which there are at present ten berths, with 32 foot draft, and room for fifteen additional berths as soon as Negro Point Breakwater is extended to Partridge Island, and railway facilities re-arranged. On account of the limited frontage, and the railway terminal situation, however, the harbor is being developed from both sides.

The entrance channel is 12,000 feet in length, and 600 feet in width, and 32 feet clear depth at low water is maintained by annual dredging—the annual siltation varies, but generally amounts to about two feet.

When the Negro Point Breakwater is extended to Partridge Island (about 1,500 feet) the littoral drift from the southwest will be arrested and the flow more concentrated in the channel will increase the scour and assist in maintaining the channel depth.

The materials dredged in the harbor are principally clay, sand, gravel and silt. There is considerable quantity of submarine rock to be removed in order to straighten the channel, but on account of the extreme cost of same this work is being delayed.

During the year, there are generally only two to eight tides below zero, forty 0.5 tides, and sixty tides 1.5 feet above zero, the remainder of the tides range from 2.3 to 6.7 feet above zero. Boats generally prefer to berth at slack water—it is, therefore, evident that the channel is navigable for the largest steamers.

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*Chief Resident Engineer, Public Wks. Dept., before Engineering Institute of Canada.

The wharves are built to provide 32 feet at low water. The harbor fortunately is free from the teredo, limnora and other sea worms. The type of construction up to the present has been timber cribwork and concrete with cribwork substructure. On account of the scarcity and high cost of timber and the necessary extreme height of the wharves, about 65 feet, other types of structure are being investigated.

The outstanding features in St. John harbor are the extreme range of tide and the consequent currents.

The inward mean tidal flow is about 20,000 c. f. s. and the outward is about 40,000 c. f. s. (The maximum surface current velocity at the minimum section in the harbor is about four miles per hour.)

Unfortuantely, no systematic meterings have to date been made of the river, and consequently the river flow is only an estimate. A series of float observations have been taken at various stages of the tide, and at various depths below surface. These show very erratic current conditions. The fresh water from the river flows out while underneath the tide rises and falls regularly.

The principal wharves are of crib work with concrete superstructure. The cribs being placed on a prepared dredged bed, covered to an average depth of five feet with broken rock. Behind the cribs, selected dredged material is filled in, on which the necessary railway sidings and sheds are built. The sheds are one story, of timber construction. At a number of the wharves grain conveyors are built from which boats can be loaded with grain at any stage of the tide. In addition to vertical fenders of 12x12 inches hard pine, floating fenders about 36 inches diameter and 33 feet long, are placed about 80 foot centres. It may be noted that in berths 15 and 16, which are more exposed to wave action, the life of these floating fenders does not exceed two years.

Courtenay Bay Development

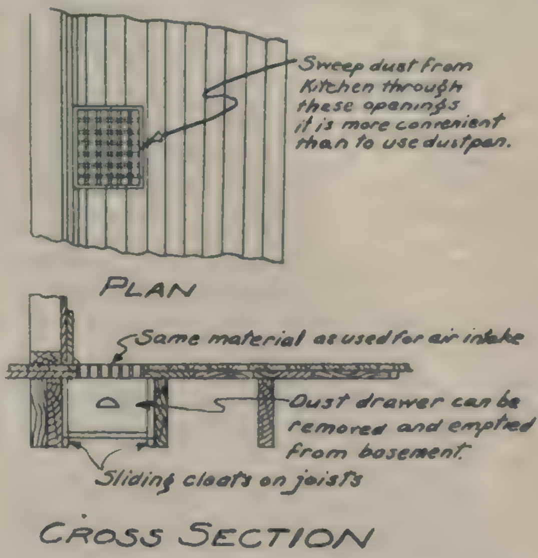
The Courtenay Bay development, on the east side of the harbor, comprises the building of a dry dock 1150 feet in length, 125 feet wide, with 40 feet of water on sill at high water, ordinary spring tides, and elevation of sill 14 feet below low water, spring tides; the building of a break water 7,070 feet long, of which 4,570 feet have been completed; the dredging of a basin 32 feet below zero and channel 22 feet below zero (zero being extreme mean low water). The details and layout of the wharves have not been decided. The breakwater is of the rubble mound type, top width 20 feet, seaward slope varying from two to one to three to one, according to location.

The breakwater does not have the exposure of Negro Point Breakwater and it is therefore not expected that the slopes will suffer the raking down experienced at the latter place. The stones at the outer end, weighing upwards of ten tons, were lifted from their beds and moved about fity feet during a storm in October last. The rock from the breakwater is obtained from the dry dock site, loaded by steam shovels and hauled by locomotive on standard track on trestle, and dumped in the work. At the outer end of the breakwater, where the embankment is wide on account of the slopes and depth, two trestles will be used to ensure the larger stones being placed outside.

St. John, on account of geographic situation and consequent long railway haul, to date is principally a winter-port. The traffic in 1895 amounted to three and a third million dollars imports, and three million dollars exports, whereas during the year 1917, the traffic amounted to sixteen and three-quarters millions imports, and two hundred million dollars exports.

Dust Drawer Under Kitchen Floor

Mr. J. Meier, writing in the National Builder describes how in finishing a house last winter, he doped out a contraption to do away with the dust pan in the kitchen where it is used the most, although this device could be placed in any or all the rooms downstairs. The device is explained by the illustration, Mr. Meier believes this is an original idea, as he has never seen nor heard of anything like it.


Sweep dust from Kitchen through these openings it is more convenient than to use dustpan.
PLAN
Same material as used for air intake
Dust drawer can be removed and emptied from basement.
Sliding cleats on joists
CROSS SECTION

Use for the Old Wood Rasp

Do not throw away the wornout wood rasp. It has important uses. Among the most important of these is the following: Have the blacksmith sharpen and turn up one end until it resembles a very flat sled runner. In this form it renders splendid service in the laying of matched flooring. No tool seems quite as effective in prying into place a rather stubborn board. Being made of steel it does not spring back when holding a warped or bowed board but holds the same securely in its place while it is being nailed.

Commissioner Wilson, of the Toronto Street Cleaning Department, is making some experiments in the use of tractors and wagon trains for the delivery of garbage to the incinerator. The main difficulty in the problem of garbage collection in large cities is the long hauls necessary, and the idea is to work out an efficient system whereby the employment of teams can be confined to short hauls, and tractors and trains used for the long hauls to the points of disposal. It will be some time, however, before sufficient practical data can be gathered to show definitely whether or not the establishment of this system is practicable and advisable.

The Council of the Royal Architectural Institute of Canada will meet on October 5th in the rooms of the Ontario Society of Architects, Toronto. Several questions relating to provincial subjects will be discussed, including the formation of an association for the Maritime Provinces.

Pneumatic Riveting in British Shipyards

A recent article in The Engineer complains of the limited use of pneumatic riveting in British shipyards. To what extent the capacity of shipyards may be affected by the use of pneumatic riveting instead of hand riveting, the following figures will show. According to information recently received from one of the leading East Coast shipyards, the best day's work on a shell with pneumatic riveting is 700 rivets of seven-eighths of an inch diameter, and for hand work, under the same conditions, 430 rivets. An average day's work however, is considerably less than this, and may be taken as being 510 rivets with pneumatic riveters against 264 with a hand squad, the figures being taken for work on all parts of one ship. The number of rivets driven per day by a riveting squad varies, of course, according to the part of the ship worked upon and the size of rivet used. The following may be taken as indicating the difference in one day's work of a hand and pneumatic riveting squad:—On the shell, with ⅞-in. rivets, hand riveting, 260 to 360 rivets, with pneumatic riveting, 500 to 550; on the deck, with ⅝-in. rivets, hand riveting, 450, pneumatic 700: on the deck, with ¾-in. and ⅞-in. rivets, hand riveting 350, pneumatic 550.

The greatly increased output of work secured by the pneumatic tool is in itself sufficient to establish its very considerable superiority over the hand method. But it has another very important advantage. A hand-riveting squad consists of three men and one or two boys. From two of these squads, three pneumatic riveting squads can be formed, thus effecting a saving of 50 per cent. in labour alone. A third advantage claimed for the pneumatic tool is that it gives both the other advantages with less exertion and consequently less fatigue on the part of the men.

With these advantages to its credit, it is nevertheless, the fact that the pneumatic tool is greatly neglected in British shipyards, as the following facts and figures, taken from the returns of 70 of the leading yards of the country, will show. Only yards having berths of over 250 ft. in length are taken. It may be said in passing, that the equipment necessary for the efficient working of a berth is generally considered to consist of a compressor plant of 1000 cubic feet per minute capacity, to supply the compressed air for driving the tools, and 60 pneumatic tools, of which 20 should be riveting hammers.

Taking the ten best-equipped yards in the country, they have, as a rule, compressor plants of 1000 cubic feet per minute per berth, but only 52 pneumatic tools, of which only 1½—on the average—instead of 20 are riveting hammers. The average of the remaining 60 yards is much below even this standard. It shows only 21 tools per berth and 333 cublic feet per minute compressor capacity per berth. Moreover, only about one-eighth of the number of riveting hammers in stock in the yards are actually used. Then again, there are 22 important yards in the country, with a total of 77 berths, which have no pneumatic plant whatever.

Shortage of riveters is, beyond question, one of the chief causes, or the chief cause of deficient output at the present moment. This shortage is no new thing in the British yards, where for the last eight or ten years the supply of riveters has fallen short of the demand. War and other causes have further reduced their number, while the volume of work has been increased. The serious effect of this state of affairs on the output of ships must be obvious. In some yards, ships completely plated cannot be launched because they cannot be riveted. The solution of the problem is to be found to a very great extent in the greatest possible use of the pneumatic tool. The United States yards, by their almost universal employment of pneumatic riveting tools, have been able to overcome their shortage of skilled labour.

Housing Problem Solved in the States

The Americans are not allowing anything to interfere with the active prosecution of the war. Every problem associated with war work has been faced and solved.

The housing problem, which has occasioned so much thought and worry in England and Canada, has been thoroughly threshed out in the United States. It was of vital importance, so the government directed its energy to the solution with most amazing results.

During the past eighteen months the erection of buildings for the American Government for many purposes has been carried on in an unprecedented manner, and upon a scale unheard of in that country, even where they have been accustomed to doing construction on a large scale. There have been contracts let for more than a thousand buildings each, with necessary water supply, sewerage system, roads, sidewalks, lighting system, and other details to make a complete town or community. Those built last year were for the soldiers, cantonments of barracks, offices, warehouses, etc., while this year in addition to these and various terminals, there are numerous housing propositions for caring for the workmen and their families, for many manufacturers engaged upon Government contracts.

The first idea of many contractors and builders is to repeat the operation of erecting a single building, by employing large forces of mechanics and laborers, and by the so-called "speeding method" build a large number of cottages within a given time. This is being done in many instances. Carpenters are put to work on different buildings just as though there were but one or two buildings to be erected.

Thus men are placed so close that they frequently interfere with one another. The material that one or two men may be using may impede the progress of half a dozen, so that such material may have to be moved and handled several times. The cost of supervision is high, as it is difficult for a foreman to look after many men. Time is taken up with changing men from one kind of work, as they finish it, to another, and in showing mechanics how work should be done, and having mistakes rectified.

Much work that is done is bound to be poor or not according to plans; and although a single building may be erected quicker in this fashion, yet the cost for labor and waste materials will be higher and the entire project can not be done in as quick time, as when the construction is done along systematic lines and according to the most approved modern management.

A short outline will show how both time and money can be saved by following the proper system.

The first consideration is to obtain and properly distribute the construction materials. This is the most important feature of the entire undertaking. A lack of material means not only a delay but a break in any well thought out plan or system of building. The material once obtained must be properly distributed. The success of the job will depend upon this.

Take the proposition of erecting two hundred houses—ten of these to be boarding houses of twelve rooms, twenty to be eight room cottages, forty to have six rooms and the rest five room houses. Thus there are four types and sizes of buildings. Forces can be organized to work on each type or size of house. If material in plenty for all the houses is being received, then the gangs or crews can be so arranged as to number and size that they can finish all the buildings of each type at about the same time.

Power saws, boring machines and such tools for working up the material can be arranged conveniently to material yards or points of receiving materials, so as to work up much of these materials without interfering with the construction of the buildings. If some 2x10-inch planks are to be cut 16 inches long, and altogether 800 of such pieces are needed, it is evident that these can be cut up by one operator on a saw, and the pieces can then be hauled and enough for each building delivered to it and neatly piled until used.

This is a common practice as it saves time and money. Consequently if this can be done, then it is just as practical to cut a thousand roof rafters of 2x6-inch plank 16 feet 9 inches long and deliver them in the same manner to the buildings. Thus it becomes only a step to have framed and cut in this manner the greater part of all the material to be used, except special pieces of something that must be measured and fitted at the building.

It is this that starts the system. Some carpenters and mechanics are given the job of framing alone, others that of erecting. As a man running a power saw and cutting a piece of timber to a certain length, with notches and at given angles, is able to repeat this operation a thousand times if necessary, better than another who must start at it anew, so it is logical for another mechanic to place floor joists over and over again on the same type of building, while another sets erect studding, a third places roof framing, another flooring and so on through each class of work.

This is the logical and practical system of erecting houses in large numbers. It means the repetition of the same operation by the same men as often as possible. It means the cheapening of work; the speeding up of a job with the greatest economy; the saving of much material; the lowest percentage of mistakes; the best workmanship possible; the handling of large bodies of laborers and mechanics with the least supervision. It means better satisfied workmen, and the easy selecting of competent mechanics.

The actual planning of carrying on such a job must depend upon the plan and character of the building to be erected. The crews and their tasks can only be decided upon from the plans. A few mistakes may occur, and for the first few weeks some changes may have to be made in the arrangement of the men and their number, but this is insignificant as compared to the numerous changes made in the crews during each day and for the entire life of the job. The building of workmen's homes is a large problem and one that will occupy the attention of many builders for several years.

Mainly Constructional

East and West—From Coast to Coast

Permits to the value of $30,000 were issued in Sault Ste Marie, Ont., during the month of August.

A new building by-law is being introduced in Guelph, Ont. Special meetings have been called to consider it.

Five steel vessels for the Norwegian government will be built at the Prince Rupert shipyards in British Columbia

The wages of the carpenters employed by the Board of Education in Toronto are being raised from 60 to 65 cents an hour.

The council of Kitchener, Ont., has granted permission to the Invalided Soldiers' Commission to build two more pavilions at the Freeport Sanitorium.

The Canada Cement Co. has just received a large shell order from the U. S., which will involve the erection of a new shop and other extensions to cost in the neighborhood of one million dollars.

The Pacific Construction Co. are making considerable improvements at their Port Coquitlam shipyards, including the construction of two new "ways," a three-storey bunk house and a new blacksmith's shop.

Permits for fifty houses at an average value of $3,500 were recently issued in Brantford, Ont. These dwellings will be erected in Lansdowne Park in connection with the housing scheme of the Dominion Steel Products Co.

At the request of the Oxford County Council, the provincial government has consented to take over the county road from Ingersoll to Tillsonburg and the one from Woodstock to Tavistock, as provincial county roads.

The council of York Township, Ont., will apply to the Railway Board for permission to issue debentures to the value of $74,000 to provide funds for the completion of certain sections of the water supply system in the west end of the township.

A two-storey office building is being built at Leaside, Ont., for the munitions works there. The building will be 60 ft. x 65 ft. in plan, and will cost about $50,000. The material used will be pressed brick with Indiana limestone trim and oak finish inside.

Hon. John Hart, minister of finance for the province of British Columbia, who has recently returned from New York, states that there will probably be an additional contract for the construction of twenty more wooden ships at Victoria by the Foundation Co.

The Senneville Development Company has been incorporated with a capital stock of $20,000, head office at Montreal. The firm is given wide scope under its charter, including real estate, construction, and lumbering; also power development in the county of Jacques-Cartier.

At a recent meeting in Port Dover, Ont., Hon. F. B. Carvell, Minister of Public Works, gave the assurance that the docks at that town would be put into immediate repair for the use of the fishing fleet and also that he would endeavor to persuade his colleagues that the work of reconstruction of the docks should be immediately undertaken.

The Department of Public Works will rebuild the damaged section of the breastwork at Fort Dufferin, N.B., by day labor, the expenditure involved being about $30,000. Crib and piling construction will be utilized in repairing and restoring the revetment wall through a frontage of 200 ft.

Tenders had been called for this work, which was made necessary by reason of damage by storms, but apparently none of the bids were considered satisfacory.

Montreal South ratepayers have approved a by-law for raising an additional $50,000 to complete the water and drainage works.

The contract for the hard surfacing of No. 3 road on Lulu Island has been let by the British Columbia government to Harrison & Lamond. Only about a mile of the road between Eburne and Woodward's Landing will be undertaken at the present time. The material to be used is called Lithia, a composition invented by the firm.

As a result of investigations and pitometer surveys, the city of Ottawa has decided to install meters on all the large commercial water services in the city. In a report to the board of control, Commissioner of Works Macallum has shown that in the case of the two largest firms the loss to the city through the absence of meters has been $13,132 a year.

Extensive plans are under way for the enlargement of the plant of the Dominion Steel Corporation, which will call for the expenditure, over a number of years, of some fifteen million dollars. The plans include a plate mill, coke ovens and absorption plants for the manufacture of coal gas from by-products; also additional extensions to the Wabana iron ore mines.

An agreement has been reached between the county of Wentworth, Ont., and the townships of Glanford and Binbrook, regarding the re-building of a bridge over Twenty-Mile creek, connecting the two townships. The arrangement is that the county will pay half the cost and the townships the other half. Plans are to be prepared by the county road superintendent.

The Hamilton-Guelph-Owen Sound Good Roads Association, which was formed for the purpose of bringing about the establishment of a highway connecting these centres, has been instrumental in having one of the Ontario Government's engineers go over the proposed route. Mr. W. Huber was appointed to make the trip of inspection and will report to the Highways Department.

The Laurentian Sanatorium at Ste. Agathe, P.Q., is to be considerably enlarged in the near future, and is to be loaned for the duration of the war and two years thereafter to the Department of Soldiers' Civil Re-Establishment. Four new pavilions are to be erected which will conform to the standard adopted by this department, also a vocational training building and a recreation hall.

Bate, McMahon & Co., already have work under way at Carling Heights, London, Ont., on the camp buildings for which they were awarded the contract at approximately $400,000. The project includes the following units: 8 barrack buildings, two storeys, 212 x 41 ft.; two men's messrooms, 261 ft. x 41 ft.; two ablution rooms, 56 x 31 ft.; two sergeants' messes; two battalion orderly-rooms, two recreation rooms, and two guard-houses—each 56 x 31 ft.; officers' quarters and mess, two storeys, 212 x 41 ft.

It is officially stated that, owing to the impossibility of securing steel rails, further construction work on the Hudson Bay Railway will be practically discontinued for the season. An arrangement has been made whereby the Canadian Northern Railway will provide a service from The Pas to Mile 189, the section of the road which has been provided with a limited contractors' service. It is pointed out that in view of the fact that terminal facilities have not yet been provided at Port Nelson there is no particular object to be served in laying the rails through to The Pas this season, even if they were available.

Representatives of the Homewood Realty Co. recently came before the council of Port Colborne, Ont., to request that the town water service be extended to Homewood Park, west of the town limits. If the company can obtain this concession they propose to have forty or fifty houses built in the park by the McEachern Co., commencing work this fall. It was also stated that the company would be willing to pay for and lay all the pipe required, if the town would agree to refund the money so spent, if at a future time the property was included in the town area. The council came to no definite decision in regard to this proposition, the mayor, however, stating that "this council will do everything it can to furnish water for the district in question, providing it can do it legally and for the best interests of all concerned. The council will give the matter serious consideration."

A delegation from Brantford and Paris recently visited Galt and outlined to a number of prominent citiens a proposal for the establishment of a provincial county highway running north and south from Port Dover, through Simcoe, Brantford, Paris and Galt. Norfolk county has already asked for the designation of their part of the proposed highway, and the Brantford people were asking the co-operation of Galt to have it extended through Brant and Waterloo counties. It was pointed out that the highway from Hamilton to Owen Sound had been taken over as a provincial county highway, and that the proposed road could connect with it; also that this north and south road would be equally serviceable, whether the new provincial highway, which is to run east and west across Ontario, passes through Simcoe, Brantford, Paris or Galt. Many of the Galt business men expressed themselves as favorable to the proposition, and it is being further taken up by the Board of Trade.

Personals

Mr. Lucius E. Allen, of Belleville, Ont., formerly engineer for Hastings county, has been appointed consulting engineer to the Nitrate Division, Ordnance Dept., U. S. army, with the rank of Captain, and will shortly take up his duties in this connection.

Brigadier General F. O. W. Loomis, D.S.O., C.B., has been appointed to command the Third Division, and granted the rank of Major General. He was a member of the contracting firm of D. G. Loomis and Sons, Montreal, and has seen some very hard fighting at the front.

Mr. H. R. Dowswell, for the past six years chief draughtsman for Ross & Macdonald, Montreal and Halifax, has commenced practice on his own account as architect, at 251 Strathearn Avenue, Montreal West, P.Q. Mr. Dowswell has made a study of industrial dwellings, the importance of which is now being recognized by large corporations.

Mr. Thomas Adams, Town Planning Adviser to the Commission of Conservation, is making a tour of Canada, and is preparing a report on the housing situation for the Dominion Government. At the same time he is making suggestions to the various provinces regarding their particular problems. When in Toronto he conferred with Prof. Chas. B. Sissons, secretary of the Ontario Housing Committee, and Mr. G. Frank Beer.

Mr. J. B. D'Aeth, formerly engineer in charge of the construction of La Loutre dam for the Quebec Streams Commission, has been appointed engineer in charge for Messrs. Fraser, Brace & Co., contractors, Montreal, on the construction of a very large concrete dam on the Spanish River, Ontario, near Sudbury. This work is being carried out for the International Nickle Co. Mr. Henry Holgate, of Montreal, is the consulting engineer.

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Municipal Piggeries

MANY cities are solving their garbage disposal problems by operating municipal piggeries. It is claimed they are not only cleaning up a nice little profit on their investment but are rendering a service to the country that cannot be measured in dollars and cents. They are producing pork, so badly needed by the allied governments, for hogs offer the best hope, perhaps, of quickly meeting the demand for more meat. They increase rapidly, mature quickly and convert a great variety of roughage, or even waste, into a variety of meat products that are in great demand now.

Between two and three thousand hogs are fed on the garbage from Worcester, Mass. Worcester has about 175,000 population and it has cost the city $7,500 to handle its garbage through the municipal piggery during the past six months. Pork sold brought $21,000 a clear profit of $13,500. This is an example of profitable conversion of waste products into a much needed staple.

Garbage produced in Denver is fed to 5,000 hogs. The Denver Hog Ranch Co., a private concern, collects and disposes of the garbage without expense to the city. This scheme has worked out very satisfactorily.

Lansing, Mich., has a municipal piggery and is feeding 190 hogs. Lansing's profit has been at the rate of $12.60 per hog.

In the United States there are over 2,400 cities having a population in excess of 2,500 each and it has been estimated that these cities produce annually over 2,500,000 tons of garbage that hogs will eat. It has also been estimated from some of the experiments above referred to that each ton of edible garbage will produce about 100 pounds of pork.

The importance of municipal piggeries has been recognized by the Bureau of Animal Industry, U. S. Department of Agriculture, which has issued Circular No. 80 on the Disposal of City Garbage by Feeding to Hogs. Copies of this circular can be obtained from the Department mentioned at Washington, D. C.

Municipal piggeries are usually built reather near the city and for that reason cleanliness and a high degree of sanitation is of great importance. Concrete construction is a good step to the desired end. Concrete feeding floors, exercising pens, feeding troughs and hog wallows are among the appointments needed.

Pulverized Coal Replacing Crude Oil as Fuel

A HEATING and power plant is being erected by the British Columbia Sugar Refinery at Vancouver, in which pulverized coal will be used as fuel instead of foreign oil now employed. This conversion is being watched with interest by many large consumers in British Columbia, and the success of the coal mines in the interior of the province and on Vancouver Island depends largely on the success of pulverized coal as fuel in industrial plants. During recent years, it became apparent that the coal mining industry in B. C. was being slowly driven out of business owing to the increased use being made by large consumers, including railway companies and big institutions, of Californian crude oil to the deriment of coal industry. The great demand for oil for war purposes, together with the shrinkage in output across the border and the measure taken to prevent exportation of it from the States to Canada, coupled with the success of experiments with pulverized coal on a New York railroad, has prompted the consideration of the pulverized coal system by industrial concerns. The B. C. refinery expect to have their plant in operation about November.

Good Roads Promotion in British Columbia

THE Good Roads League of British Columbia held their annual convention at Penticton, B.C., on Tuesday, Sept. 18. It was attended by over one hundred delegates from all parts of the province, and was marked by an enthusiasm which bids fair for the success of the "good roads" cause in that province.

Reeve F. M. Smith, of Penticton, opened the proceedings with a brief address of welcome. He was followed by the president in a short address calling atention to the importance of connecting the coast with the interior by a good road. Nothing of a tangible character had so far been accomplished by the league, but good educational work had been done, and he believed that in the after-the-war period the effect of this work would be seen in great strides in the construction of roads all over the province, and that a connection with the neighboring provinces would be made.

The value of what he described as a tourist industry was emphasized by Mr. Cuthbert, of Seattle, a representative of the Western Washington Association. Over $700,000,000, he stated was spent every year in the United States by tourists. All of that money was available to people who went after it and the most important of all methods of securing tourist traffic was making roads so good that they would want to go over them. Over $7,500,000 had been spent by automobile owners in their travels in the Pacific Northwest and with the development of roads in British Columbia a very much greater proportion of the money would be spent there.

Good roads make for co-operation between town and country, and in a pointed address, Mayor Gale, of Vancouver urged a closer connection between the producer and consumer. "One of my dreams," he said, "is to see the people of Vancouver buying all their fruit from the Okanagan and other home fields generally. Of apples alone we bought last year no less than $299,000 worth, and of these over half were imported, and of all the fruit we bought last year over $700,000 worth was brought in from outside." This should not and would not be if there was the spirit of intelligent co-operation between growers and consumers that there ought to be. The channels through which the produce had to come were too roundabout and there were too many middlemen adding their profit to the consumer's cost, but he believed that a condition that would help both producer and consumer could easily be brought about.

In the absence of Hon. Dr. King, provincial minister of public works, who was to have addressed the convention, Hon. J. W. deB. Farris, attorney-general spoke. The question of transportation, he said, went to the very root of the problem of the development of British Columbia, and he held that the government was sympathetically alive to that fact, and ready to do everything possible to further the great cause. The convention was considering problems, but the government also had problems for these were very difficult times. In 1912 the government had $5,000,000 to spend on roads, money that would then do the work of at least $7,500,000 now. This year they could only find $1,600,000 for road building.

In concluding, Mr. Farris pleaded for less sectionalism in the province, and referred to the need to keep in mind the day when the men would come home from the front, and to reserve as much construction as possible in order that there would be less of the dislocation of business which was almost sure to follow.

Increased food production and conservation was the subject of an address delivered by Mr. George D. Ireland, of Vancouver, while Acting City Engineer Stewardson, of New Westminster, spoke on good roads.

Keep to the Right.

Among the resolutions passed was one calling for a change in the rule of the road, making the British Columbia rule conform to that of the other provinces.

Other resolutions were carried as follows: requesting that a section of road be constructed from Rossland eastward to Trail, Brilliant and Thrums; that the government make an investigation of the feasibility of the various routes for the proposed trans-provincial highway, before any action was taken; that all horse-drawn vehicles be obliged to carry lights; that the government put all alien enemies, interned and otherwise, at work.

Mayor Gale, of Vancouver, pointed out the futility of passing resolutions if no action were taken in regard to them, suggesting that after the convention a memorial should be framed embodying all the resolutions, and that this memorial should be circulated in districts concerned for signatures in order that the government could be shown that there was a solid body of electorate back of the movement. The Mayor's resolution was acted upon.

The election of officers for the coming year resulted as follows:—

Hon. president, W. A. McKenzie, M.P.P.; president, Mayor Gale of Vancouver; Ernest Waterman, Princeton; J. E. Meighen, Kamloops, and Mrs. Goddard, first second and third vice-presidents, respectively; J. S. Heales, Penticton, secretary, and J. H. Cunningham, New Westminster, treasurer.

The following directors were also appointed: Mayor Todd, Victoria, and Reeve Borden, Saanich, for Vancouver Island; Reeve Vison, North Vancouver district; J. J. Johnston, New Westminster, and Mayor Ashwell, Chilliwack, New Westminster district; Mayor Shatford, Vernon, and W. F. Sumners, Kamloops, North Yale; J. W. Jones, M.P.P., Kelowna, and F. Harvie, Princeton, South Yale; Mayor Acres, Grand Forks, and Jos. Kerr, Rock Creek, Nelson district; E. M. Genier, Trail, and Mr. Willison, M.P.P., Revelstoke; S. Herchimer, Trail, and C. Cummings, Golden, East Kootenay; R. Rutherford, 150-Mile House, and G. McLaughlan, South Fort George, Cariboo; Robt. Roxborough, Atlin.

Mayor Gale, Vancouver

Push Scraper for Levelling Edge of Fill

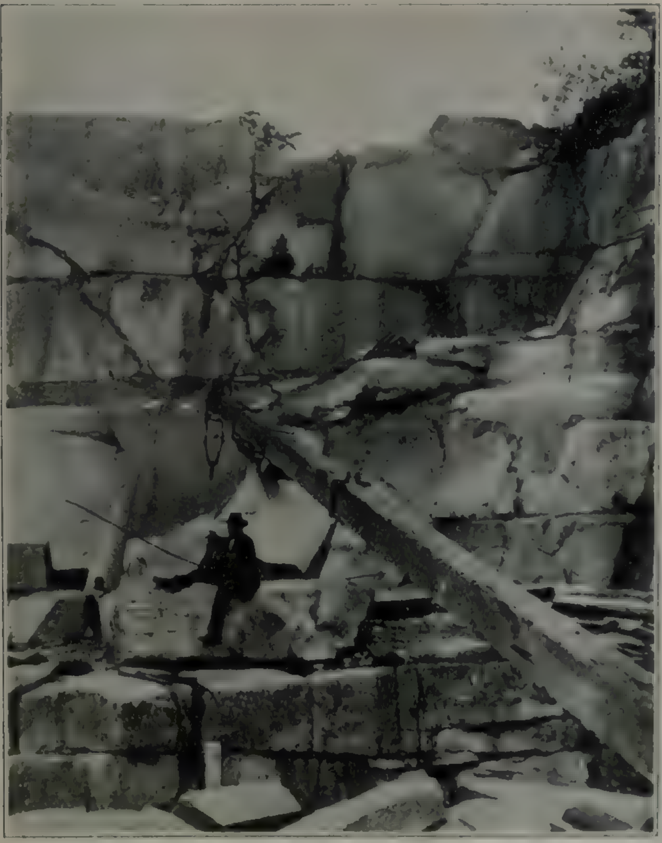
A push scraper has been found an effective tool for leveling the edges of fills. As employed by a Chicago contractor the arrangement consists of a long piece of timber attached to the front wheels of a wagon. The rear end of the timber is counterweighed and the front end carries a plank scraper. The horses are hitched midway of the timber and are alternately backed up and driven ahead, pushing the dirt over the edge of the fill in the forward motion.

Building and Ornamental Stone Occurring in the Province of British Columbia

ONE of the most important factors in the permanence and character of any nation's buildings is the occurrence and nature of its stone deposits. From time to time the Canadian Department of Mines, the Mines Branch of which is under the directorship of Dr. Eugene Haanel, has issued valuable reports, many of which have been reviewed at length in the Contract Record. The latest, and also one of the most comprehensive and interesting, is that referring to the building and ornamental stones of the Province of British Columbia, prepared by W. A. Parks, Ph.D., Associate Professor of Geology, University of Toronto:

The commercial production of building and ornamental stone in British Columbia is confined to the sandstones of the Gulf islands; the granites of the Coast range, Okanagan lake, and the Nelson district; and the marbles of Kootenay lake, Texada island, and Nootka sound.

The sandstones have been quarried near Nanaimo and at Koksilah on Vancouver island, and on Denman, Hornby, Newcastle, Gabriola, Saltspring, Mayne, Pender, and Saturna islands. The stone is normally of a greyish-blue color, but it alters rapidly to buff, and is quarried in that condition to some depth from the surface in certain of the quarries.



Granite quarry of the West Coast Granite Co., Fox Island, B.C.

The granites of the Coast range vary greatly in mineral composition, color, and grain. The most important quarries in a medium-grained grey type of stone, are on the islands off the mouth of Jervis inlet. Stones of darker color have been quarried in small quantity near Prince Rupert, and also at Agassiz and Cathmar on the line of the Canadian Pacific railway.

The Nelson granites are of the same general type as the Coast range stones, but they are lighter in color, and usually coarser in grain. The Okanagan granites are of medium grain and pinkish color; they have been quarried to a very small extent for local use only.

A white and blue-banded marble is quarried north of Kootenay lake, and a very similar stone has been procured from Nootka sound on the west coast of Vancouver island. In the interior and at many points along the coast occurrences of marble of this same general type have been reported, but all that have been investigated seem to be too scattered for commercial exploitation. A very handsome red marble has been worked to a small extent near the southern extremity of Texada island, and fine-grained red and white varieties occur in abundance in the mountain above Grant Brook on the line of the Grand Trunk Pacific railway.

Decorative stones other than marble have received little attention, but some of the dark basic rocks of Rossland and Ymir are mentioned as sources of monumental stone. Sodalite and sodalite-bearing syenite from Ice river, fine black carbonaceous slates from Queen Charlotte island, and basic phases of the Coast range rocks are of possible value as decorative stone.

Geology of British Columbia from the Point of View of the Building Stone Industry

The whole of the Province of British Columbia lies within the great mountainous tract which forms the Pacific border of the North American continent, and is commonly called the Cordilleran region. The coast of British Columbia and the mountain ranges forming the cordillera have a general trend to the north of west. The width of the province, measured at right angles to this direction, is almost 400 miles, and its eastern boundary follows the height of land of the most easterly system of the cordillera—the Rocky mountains proper—from the international boundary to latitude 54 degs., north of which it is coincident with the 120th meridian to the southern boundary of Yukon territory.

The eastern part of the province, throughout its entire length, is characterized, therefore, by the great masses of the Rocky mountains, rising in places, to altitudes of 11,000 and 12,000 feet. The western or Pacific border is likewise of truly mountainous character, with the peaks of the Coast range rising to 8,000 feet and more above the level of the sea. The broad belt of country between the Coast range and the Rocky mountains is of less average elevation, but it nevertheless presents imposing mountain ranges, particularly in the southern part of the province.

Immediately west of the Rocky mountain system is a pronounced depression, which extends from Montana to the Yukon boundary, and contains the upper valleys of the Columbia, Fraser, Peace, and Liard rivers. This great depression is known as the Rocky

Mountain trench. In the southern part of the province, the Rocky Mountain trench is bounded on the west by the Purcell range of mountains, beyond which lies a second depression of less magnitude—the Purcell trench—in which are the valleys of the Beaver, Duncan, and Kootenay rivers. The Selkirk system of mountains lies west of the Purcell trench, and rises to altitudes of more than 11,000 feet. The valley of the Columbia river, in part occupied by the Arrow Lakes, lies west of the Selkirk range, and is succeeded westward by the Columbian system of mountains. These mountains while rugged, are a less defined topographic unit, and fade into the broad region known as the interior plateaux, which continue to the eastern boundary of the Coast range.

Granite quarry of the Sechelt Granite Co., Hardy Island, B.C.

This great interior region, while flat in comparison with the great mountain ranges, is nevertheless of a rugged character, with an average elevation of 3,500 feet, and with peaks rising as high as 5,000 feet. In the northern part of the province, where not constricted by the intermediate ranges mentioned above, it is of greater width, and extends from the Coast range to the Rocky mountain trench. Still farther north it is less pronounced, and is interrupted by the Telegraph and other northern ranges.

Vancouver island and Queen Charlotte island represent a bordering range belonging to the same system as the Coast range and separated by the depression in which lie the Strait of Georgia, Queen Charlotte sound, and Hecate strait.

Early in the geological history of the North American continent, it is likely that a great land mass existed in the central and western parts of British Columbia, and that the sea covered the area at present occupied by the Rocky mountain and Purcell ranges. The rocks of this continental mass were doubtless derived from the decay of a still earlier, unknown land, for they are essentially of sedimentary origin although invaded by igneous rocks of many kinds and intensely altered by the long-continued action of the forces of nature. This series of rocks was greatly reduced by erosion throughout vast periods of time, in part depressed below the sea, and covered by later accumulations, both sedimentary and volcanic. At present, these rocks, known as the Shuswap terrane, are to be seen only in a limited area in the Selkirk and Columbian mountains. The characteristic appearance of the Selkirks, with their sinuous, rim-like crests, and intermediate snow fields, attests the great age of the rocks, and their long-continued glaciation. This great series is divided into at least five formations: showing gneisses, quartzites, schists, and limestones, and is capped by a mass of greenstone (Adams Lake greenstones) which attains a thickness of 10,000 feet.

Sandstone quarry on Denman Island, B.C.

As we have already seen, a great depression (Rocky Mountain Geosyncline), occupied by an arm of the sea, lay to the east of the early landmass. The floor of this basin gradually sank throughout many succeeding geological ages, with the result that, the debris from the land surface accumulated in the form of new strata to an enormous thickness. Later, came an upwarping of the western part of this basin, whereby the region of the Purcel range and the western ranges of the Rockies became land. Sedimentation still continued in the eastern part of the basin, which remained under water to the close of Cretaceous time.

The western part of the province seems to have remained a land surface until Pennsylvanian (Upper Carboniferous) time, when it also was partly submerged, and strata of that age were deposited on the western flanks of the axis. These were succeeded by shales and limestones of Triassic age, the deposition of which was accompanied by extensive

Marble blocks and portal of quarry of the Canadian Marble and Granite Works, Marblehead, B.C.

vulcanism, with the effusion of enormous masses of basalt (Nicola group). Extensive earth movements now began to affect the western region, and resulted in a folding and puckering of the Pennsylvanian and Triassic strata. These disturbances paved the way for the enormous outburst in Jurrassic time of granite and related rocks which now form the core of Vancouver island, and extend for a distance of more than 800 miles along the coast of British Columbia—in the great bordering mountains known as the Coast range.

We have seen that rock-forming continued in the eastern basin during Jurassic time (Fernie shale), and we likewise find Jurassic sediments in Queen Charlotte islands and in the northern parts of the province. Cretaceous time is also represented west of the Coast range by the sandstones and shales of the islands, and east of the range by the Hazelton series of the north and the sandstones and conglomerates of the lower Frazer river.

At the close of Cretaceous time occurred those vast movements whereby the eastern cordilleran region was broken into huge blocks by fissures having a general northwest trend. Enormous pressure from the direction of the Pacific ocean elevated these blocks into the great ranges of the Rocky mountains.

From that time to the present, the geological history of British Columbia is largely one of sub-aereal decay, and intense volcanic activity. Strata of Tertiary age are confined to local accumula tions, in narrow valleys in the western area. The Oligocene division of the Tertiary is marked by great volcanic flows, and fissure eruptions, which built up the great masses of igneous rocks characterizing the mining regions of southern British Columbia. The Miocene was a period of profound erosion across the cordillera, while the Pliocene witnessed a general re-elevation of the region, whereby new life was given to the streams, and a second cycle of erosion inaugurated.

The Sandstones of the Province

Sandstone suitable for structural purposes forms a large part of the Upper Cretaceous system as exposed on the islands of the Strait of Georgia, and to a less extent on the mainland of the southern part of Vancouver island. From this region has been derived all the structural sandstone quarried in British Columbia. The Lower Cretaceous formation of Queen Charlotte island (Queen Charlotte Island formation) consists largely of sandstones of unknown possibilities, and the Upper and Lower Ribboned sandstones of the Fernie coal-mining district are capable of use for local rough building; but the stones are too hard and of too poor weathering properties to be regarded as building stones in a commercial sense. The sandstones of the Skeena and Hazelton formations of the northern parts of the province are extremely hard, extensively fractured, and apparently of no promise whatever. No attempt has been made to quarry the Tertiary sandstones of the southern part of the province: they appear to be too soft and incoherent for our purpose.

The sandstones vary much in grain and colour, but usually present a tint between bluish-grey and yellow. In many instances the original colour is bluish-grey, and the buff or yellow varieties are the results of oxidation.

The commercial stones vary in colour from blue-grey to buff, and in extreme cases, to yellow. The blue variety has a strong tendency to become buff on exposure; in every case this change was effected by the corrosion test. While varying greatly in grain all the

Granite quarry of the Vernon Granite and Marble Works, Okanagan Lake, B.C.

stones show a very similar composition: quartz, both varieties of feldspar in a fairly fresh condition, and dark grains of volcanic rock matter. The latter constituent has a tendency to occur in larger fragments, and usually makes up the bulk of the pebbly streaks common in many of the exposures.

The Cowichan Group.

The only sandstones of commercial importance in British Columbia are quarried from the islands adjoining the Vancouver coast in the southern part of the Strait of Georgia. The normal stone is of blue color, but by oxidation the superfiicial part of the outcrops become altered to buff. Both varieties are employed for building. The most important quarries are on Gabriola and Saturna islands, whence stone has been taken for many important buildings in Victoria and Vancouver. A harder stone of more nearly true grey colour was formerly obtained from Newcastle island near Nanaimo, but the quarry has not been operated recently.

The Granites and Related Rocks of the Province

True granite is a rock of igneous origin, which has cooled from a state of fusion at great depths in the earth. In consequence of this manner of origin it consists entirely of crystals which are approximately of the same size. The minerals represented by these crystals are quartz, orthoclase or potash fieldspar, and mica. The last mineral may be replaced in whole or in part by others of like nature giving rise to varieties distinguished by prefixing the name of the mineral which replaces the mica, e.g., hornblende granite.

The term "granite" in the usage of builders and monument makers is of much wider application, and may be employed for almost any igneous rock, but in the case of the very dark stones it is customary to prefix the adjective "black." This use of the term, while quite indefensible on scientific grounds, has been adopted throughout this series of reports and will be retained for the present volume. Most of the British Columbia stones herein called granite are really granodiorites, which differ from true granite in the presence of soda-lime feldspar or plagioclase, in addition to the orthoclase. The total failure of orthoclase and its replacement by plagioclase makes the rock quartz diorite, and a rock with the composition of granite, but without quartz, is syenite.

On geological grounds the commercial granites of British Columbia may be considered under three heads as follows:—

1—Ancient granites of Pre-Cambrian time, included in the Shuswap terrane, and quarried on Okanagan lake.

2—Granites of the great multiple batholith of the Coast range, quarried at a number of points on the coast, and to a less extent inland.

3—Granites belonging to intrusions of later age than Jurassic. The chief of these is the granitic mass in which are situated the quarries near Nelson.

Practically, the better known commercial granites fall naturally into four groups, as follows:

1—The reddish, coarse to medium-grained granites of the Shuswap terrane which are quarried on Okanagan lake.

2—A series of rocks of general granitic appearance showing clearly three constituents to the naked eye, and usually presenting a grey or slightly pinkish colour. These stones are all granodiorites. Arranged in order of grain from fine to coarse the more important representatives are as follows:—

i—Granites on the Canadian Pacific railway west of Nelson.
ii—Granites of Jervis inlet
iii—The coarser type of Jervis Inlet stone, and the granite of Three-mile point Kootenay lake.

3—The rocks of this class are darker in colour and differ from the second series in presenting to the naked eye a general effect of two constituents only—a sharply defined, black component, and a similarly defined white ingrediont. The rocks included here vary from granodiorites to quartz diorites, and pass insensibly into the types commonly called black granites. The more important representatives of this class arranged in order of grain from fine to coarse are as follows:—

i—The quartz diorte of Agassiz on the main line of the Canadian Pacific railway.
ii—The granodiorite of Smith island.
iii—The granodiorite or quartz diorite of Tyee on the Grand Trunk Pacific railway.

4—The quartz diorite porphyrites of Cathmar on the Canadian Pacific railway and of Little Canyon on the Grand Trunk Pacific railway.

Granites of the Coast Range.

The most important building and monumental granite of British Columbia is furnished by the great range of mountains which extends for nearly 1,000 miles along the coast and is known as the Coast range. The general rock of these mountains is a greyish granodiorite varying to quartz diorite or even to dark basic phases such as gabbro. The best known commercial stone is the grey granodiorite of Jervis inlet which is quarried on Nelson, Hardy, Fox, and Granite islands.

Stone from these quarries has been extensively used for building purposes in Victoria and Vancouver, and has been shipped abroad; it has also been employed for monument bases, and the darker type from Granite island has been in demand for monuments. The following are good examples of buildings constructed of Coast Range granite from Jervis inlet: Base of Parliament Buildings and the sea-wall, Victoria (Frontispiece); First Baptist church, Vancouver; Bank of Montreal, Victoria; Post-office and Winch building, Vancouver; Canadian Bank of Commerce, Vancouver.

Stone not essentially different from the Jervis inlet type has been quarried to a very small extent on Pitt lake and near Agassiz on the main line of the Canadian Pacific railway. Darker coloured stones of less granitic appearance occur on the islands off the Skeena river and also along the line of the Grand Trunk Pacific railway. Pinkish granites of varying grain are of common occurrence on many of the islands in the Strait of Georgia.

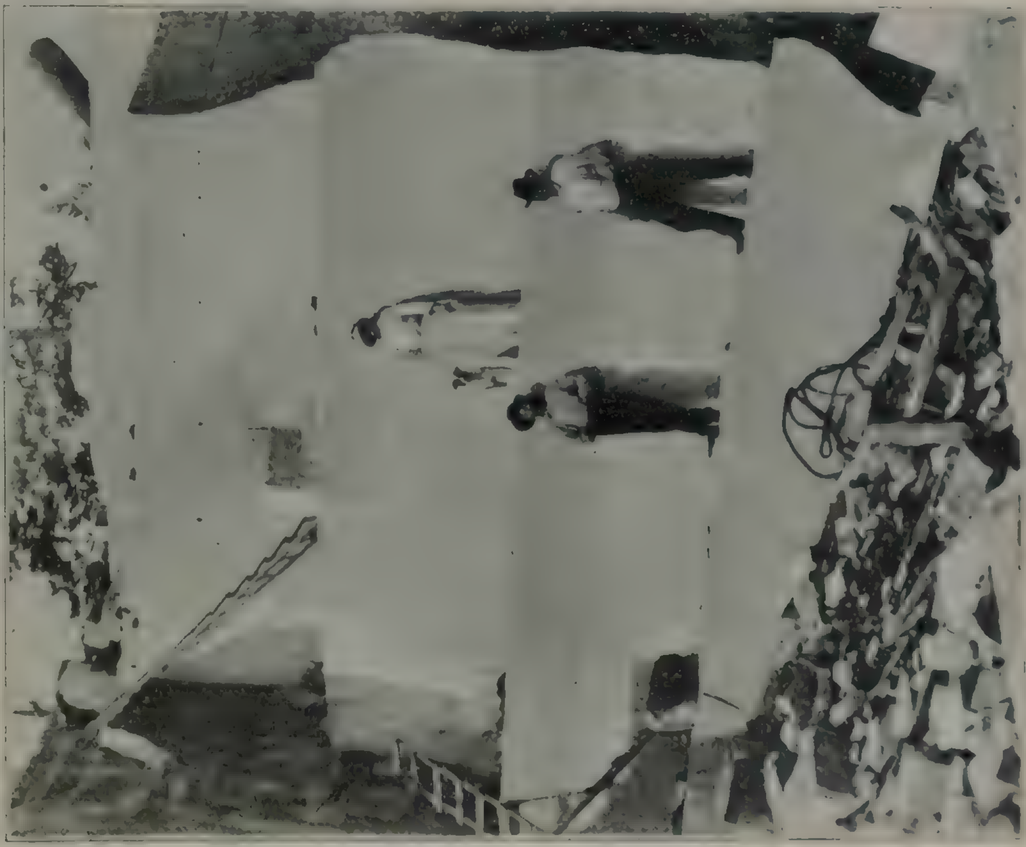
Granites of Late Jurassic or Post-Jurassic Age.

In Vancouver island and on the mainland to the east of the great masses of the Coast range occur stocks and batholiths of igneous rocks which, in the general terms adopted for this report, are called granite, although none of them are granite in the strict sense of the word. The only commercially important quarries are situated near Nelson where a greyish granodiorite, somewhat similar to that of Jervis inlet, has been worked to a considerable extent. A greenish granodiorite of very inferior quality has been used locally at Greenwood; a peculiar rock (quartz diorite porphyrite) is proposed for structural purposes at Little Canyon on the Grand Trunk Pacific railway; and some of the masses of southern Vancouver island are thought to be capable of yielding structural stone.

Black Granites of British Columbia.

The term "Black Granite" is commonly applied by quarrymen and monument-makers to all types of dark-coloured igneous rocks; the expression has no definite scientific meaning. Many of the eruptive rocks of the mining districts of the southern part of the province may be of possible value as monumental stone, but the only examples which have attracted any attention

Sandstone quarry on Jack Point, Nanaimo, B C



Granite quarry of the Vancouver Granite Co., Nelson Island, B.C are the monzonites of Rossland, Coryell, and Ymir. Monzonite is a dark rock consisting essentially of orthoclase, plagioclase, and a dark ferro-magnesian mineral such as hornblende. The Rossland stone has been used for monuments and for buildings. The Coryell stone is a coarser and rougher type; it has been quarried for rough masonary and for building. The Ymir stone is a coarse-grained variety with glistening mica as a characteristic feature; it has not been systematically quarried but a few blocks have been taken out for monuments.

Phases of the Coast Range batholithic rocks are dark enough to be included here, particularly the gabbros on some of the islands of the Strait of Georgia, Queen Charlotte sound, and Hecate strait.

Marbles of British Columbia

Limestone which by alteration due do natural agencies has become crystalline, is called "crystalline limestone"; and this, when possessed of a certain fineness of grain or other qualities giving it a handsome appearance, is called "marble." In some cases limestones are classed as marble, although crystalline structure is absent or but slightly developed, if the stone is of sufficient beauty for use as ornamental material.

Owing to the intense metamorphism to which the rocks of British Columbia have been submitted, practically all the limestones have been rendered crystalline, but the application of the purely commercial term "marble" is a question for further investigation. No general attempt will be made in this chapter to distinguish between crystalline limestone and marble; the distinction can be made only in those individual cases which have been more fully investigated from the economic point of view.

British Columbia does not rank high as a producer of stone of this class; actual production has been confined to the following localities:—Marblehead, north of Kootenay lake; Nootka sound, Vancouver island; Northern Texada island; Southern Texada island; Grant Brook, Grand Trunk Pacific railway.

Of these, only the Marblehead quarries and those of southern Texada island have shipped any stone beyond a few blocks for experimental purposes. The list may be extended, however, by the addition of a few localities which have produced a coarse crystalline limestone, suitable only for building purposes and which could scarcely be included in the category of marble: the chief of these are:—Kootenay lake, opposite Kaslo; Grand Forks; Sheep Creek.

Bands of crystalline limestone occur in practically all the sedimentary formations from the Shuswap terrane to the latest Mesozoic strata. The localities of occurrence, therefore, are so numerous that it would be futile to attempt a categorical list in a work of this kind.

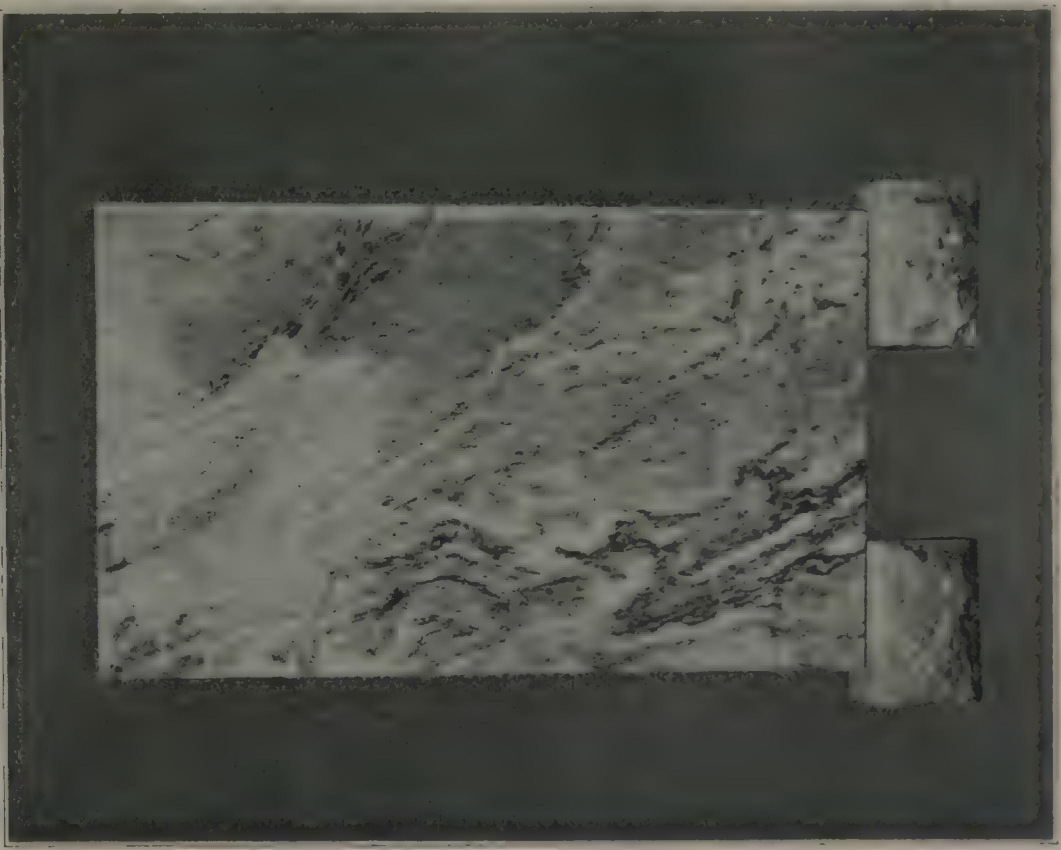
Crystalline limestone more or less suitable for marble occurs in many of the rock formations of British Columbia from the Shuswap to Jurassic. The great ranges of the Rockies contain Cambrian marbles in quantity; the Shuswap marbles are quarried on Kootenay lake; Triassic and Jurassic marbles are known in Vancouver island and on the islands of the straits; and Carboniferous marbles have been quarried to a very limited extent at Sheep creek in the Nelson district and elsewhere. Commercially the known marbles are of three general types as follows:—White and blue-banded stones; Reddish crinoidal marbles; Pink and white, fine-grained dolomitic marbles.

Marbles of the first type are the most common and are remarkably alike irrespective of the formation from which they are obtained. Important quarries are situated on the Lardeau branch of the Canadian Pacific railway north of Kootenay lake, and extensive operations were attempted at Nootka sound on the west coast of Vancouver island. The only commercial production has been from the Kootenay quarries. The red crinoidal type of marble is found only in the southern part of Texada island. Operations have been conducted on a small scale but the Malaspina Marble Company propose to further exploit the deposit. The pink and white dolomitic marbles occur at Grand Brook on the line of the Grand Trunk Pacific railway. Operations have not passed the development stage.

Engineering Appointment with U.S. Army

Mr. Lucius E. Allen, C.E., Consulting Engineer, Belleville, Ontario, as stated in our last issue, has been notified of his appointment as consulting engineer to the Nitrate Division, Ordnance Department, U. S. Army and expects to leave almost immediately to assume his duties. Mr. Allen will hold the rank of captain, and will have charge of very important work in connection with war activities. During his residence in Canada the past thirteen years, he has taken a very active part in the social and business activities of his city and Eastern Ontario, having been county engineer of Hastings County for seven years, a director of the Ontario Good Roads Association, and managing director of Ontario Limestone & Clay Co. Ltd., since its organization. He has been a frequent contributor of articles on highway bridge construction and good road problems to the Contract Record. Mr. Allen is a member of the American Society of Civil Engineers, the American Institute of Chemical Engineers, Honorary Secretary for Eastern Canada of The Institution of Municipal Engineers (Great Britain) and a member of the Permanent International Good Roads Congress (Paris, France), the Engineers Club of Toronto, the Ontario Club, the Chemists Club of New York City, etc. and is well qualified to assume the important work which will devolve upon him. Mr. Allen's business and offices will continue to be operated for the present by his associates.

Captain Lucius E. Allen.



Kootenay marble, Canadian Granite and Marble Works, Marblehead, B.C.
(About one fourteenth natural size)

Granite quarry of the Canadian Pacific Railway Co. at Cathmar, B.C.

Possibilities of Greater Salvage and Utilization of Waste

By David Currie*

I THINK we have all come to realize in these days what a wasteful nation we have been—how prodigal with our resources! The reason for this is perhaps not far to seek. The bulk of the world's raw materials was at our disposal; we had the money to purchase them and the ships to bring them to our shores; it was far less trouble to use new material than to bother about the old, which was accordingly either thoughtlessly consigned to the scrap heap or ruthlessly destroyed.

We are, I think, naturally an improvident people, and we forgot the first great principle of Nature—viz., that matter is indestructible and, properly manipulated, can be used again and again. We invented the word "rubbish" to describe not what was useless, but what we were too indolent to collect and prepare for further use, and thus introduced waste—a word which only has a meaning when the material wasted is of some intrinsic value. We cannot waste what is of on value, and therefore by the expression utilization of waste we mean the utilization of material which is of potential value, but which is at present being wasted either by destruction or neglect. The truth of the old saying, "Waste not, want not," is now coming home to us, and we are beginning to realize what an important part salvage can play in helping to win the war, and how still more important it will be in those anxious days of reconstruction which will follow when every scrap of raw material will be required, not only for our own needs, but for the needs of those bruised and battered countries where the monstrous ambitions of the German Apollyon have wrought such rack and ruin.

An Urgent National Need.

For years and years, gentlemen, the energies of most European nations will be devoted to salvage in its widest sense, and while the wreckage and waste of war is being cleared away every scrap of material which can be salved will be invaluable, while in the industrial struggle which is bound to come the possession of raw material will undoubtedly prove the dominating factor. Salvage, therefore, is to us as to all other countries an urgent national need, and we must set ourselves with all our hearts and souls to master a subject which has been so carelessly—one might almost say criminally—neglected in the past.

We have only to look around us to realize at once what ample opportunities there are in every direction for organized salvage in this country; not the least important of these directions is that in which you gentlemen, are most interested—viz., municipal salvage. I will not stop now to inquire whether this form of salvage pays or not. I am advised that it can be made to pay, the experience of some local authorities certainly shows that this is so; but at the moment this seems to be a question of secondary importance; and even if salvage is to be carried on at a temporary financial loss carried on it must be, for above everything else at the present time we need the commodities which can be salved and the tonnage which can be freed, and our necessity for these things is so great that they must be obtained even if the result should be a debit instead of a credit balance.

In the United States of America salvage is being energetically taken up by the Food Administration. The United States Food Administrator has pointed out recently that twenty-four cities of over 100,000 inhabitants are not utilizing garbage and are therefore wasting the equivalent of 4,400,000 lb. of nitroglycerine and 40,000,000 12-oz. cakes of soap besides enough fertiliser to produce a 3,000,000-bushel wheat crop. Twenty-nine other cities on the other hand, are saving products worth over $10,000,000 per annum, and that a large percentage of these products are being directly used by the Government for munition making; but even in these cities there is still being wasted sufficient grease to produce enough nitroglycerine to furnish the powder charge for about 2,000,000 shells of the famous "75's." Three hundred cities of over 10,000 are disposing of their garbage for pig food, and the estimated yield of pork should be 100,000,000 lb.; but owing to bad methods of separation it is actually only 50,000,000 lb., worth $8,000,000. On the other hand, 350 cities are not using their garbage and are thus losing 60,000,000 lb. of pig food annually.

What is France doing? I have seen a report within the last few weeks on the Possible Salvage from Household Waste in Paris. We all know that the Paris "ragpicker" had an European reputation, and he still seems to live up to it, for this report states that with the exception of certain vegetable matter. "nothing escapes from the sorting of a multitude of men, who recover everything that commercial ingenuity enables one to utilize. The intervention of those men begins from the time of the throwing into the streets and is continued up to the incinerator." The problem in Paris thus narrows itself down, says the writer of the report, to the salvage of vegetable waste. So much for our gallant Allies.

Let us turn to a neutral country. In Switizerland the Department of Economics issued in June this year special instructions for the collection of kitchen and garden refuse. This speculative and uncontrolled collection of refuse will be strictly prohibited.

German Methods.

And how about the enemy? Prof. Stephen Leacock, who is the American Lewis Carroll, recently wrote a book in which he described a dream that he was in Germany. In one passage he says: "There were two peasants working beside the road. One was picking up fallen leaves and putting them into neat packets of fifty. The other was cutting off the tops of the late thistles that still stand unwithered in the chill winter air and arranging them according to size and colour. In Germany nothing is lost—nothing is wasted. It is perhaps not generally known that from the top of the thistle the German obtain picrate of ammonia, the most deadly explosive known to modern chemistry, while from the bulb below, butter, crude rubber and sweet cider are extracted in large quantities."

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*Director General of National Salvage, England, before Institute of Cleansing Superintendents.

This, of course, is a jester's dream, but it is not so very far removed from the grim reality of the waking truth. Although Germany is not putting up her leaves in packets of fifty, it is reported that she is using dried beech leaves as a substitute for tobacco; although she is not using thistle-down she is cultivating nettles to obtain textile fibres.

Let us stop for a moment and ask ourselves, "How is it that the Hun, who has been for nearly four years totally—or at least partially—blockaded, who is surrounded by starving peoples, who has cast all his resources, human and material, unreservedly into the business of war, is still able to carry on with vast armies apparently as well equipped as our own, with all the world's markets open to us from which to draw our raw material, and with half the world's factories working overtime on our behalf?

Take the case of clothing, for example. Germany's own production of wool and that of her neighbours is not nearly sufficient for her needs, and possibly of all materials this is one against the import of which Germany has been most effectively blockaded, and yet her armies in the field are nearly, if not quite, as well clad as our own. Quite early in the war optimists predicted that Germany must soon run short of this, that or the other essential, but she is still fighting apparently strong, boastful, and well-equipped as ever. How is it done? By salvage in its widest senses—organized salvage, carefully planned and developed for years as part of her preparations for war.

As the following notes will show the German is a past master in this science, to which we are only beginning to turn our attention.

In each village in Germany the chief magistrate has the duty to see that the inhabitants of the village bring all their waste material to the official collecting centre; the time at which this has to be done is announced by placards every month or half-month. Every head of a family or head of a household is bound (under pain of punishment) to see that nothing is wasted; everything that seems useless must be collected. The waste material of greatest value is metal—useless cooking utensils of all kinds of metals, worn-out tools and other workmen's implements, ribbons, wire, nails, etc. Among the country people the waste material from the kitchen is used for feeding the animals. The population of the town has, on the contrary, to give up every kind of waste from the kitchen daily. For instance, it is obligatory to remove the grease from plates and dishes by heating them and washing it off with a very little water, which is then collected in pails. Statistics showed that in Berlin 4,000 to 5,000 kilos of fat were obtained daily from the collection of rinsing water (in the town alone). This fat is used for lubricating grease and for the manufacture of soaps.

The skins of all kinds of small animals (hares, rabbits, etc.), every kind of hair, feathers, etc., must all be collected. In the larger towns carts and motors have been organized for this purpose, and these go round to each house every day in the morning at a fixed hour, at which time the inhabitants must bring the waste material down and empty it into the carts. In Berlin and the other big towns the whole business must be finished before 7 a.m.

As the slaughtering is under State control, and takes place in the bigger towns only in big slaughter-houses, special appliances have been invented which catch all the waste, such as blood, hair, etc. The rare home slaughtering which takes place in the country is also under the supervision of the magistrate, and here also all the waste must be collected.

Special arrangements have been made for transporting the corpses of animals which have died of disease to special factories, where they are immediately put into use. The work is done without any smell, as the whole apparatus is hermetically closed. A whole body can be thrown into the dissolving oven. Fat is obtained first of all by this process; then gelatine (glue) and other stuffs which are used in various branches of industry. There is another apparatus which concentrates and utilizes the gases of putrefaction. The remainder of the corpses is used for chemical manures.

In order to obtain oil, all the pips and kernels of fruit, especially peaches, plums, and apricots, are collected—and also the pips of apples and pears. The school-children are particularly used for such collections. Not a kernel or a pip may be thrown away. The official collectors have had advertisements put up in all public buildings, restaurants, stations, etc., to the effect that everyone is to collect the stones and pips, and is to bring them to the collecting centres. mostly instituted in the schools or in the municipal buildings. The school-children are used also to collect acorns and beech nuts; beech nuts make very good salad oil. The collecting centres at Stuttgart published a report in 1917, according to which 150,000 kilos of oil had been extracted from the fruit kernels, acorns, horse chestnuts and beech nuts collected by the school-children.

Possibilities of Municipal Salvage.

Let us now return to the question of our own salvage, particularly municipal salvage.

The subject is a very large one, and may be dealt with under three heads: (1) What kind of material and what quantity is at present being wasted? (2) How can it best be salved? and (3) How best utilized?

It would be impossible for me, even if I were able to do so, to deal fully with each of these branches of our subject, and I propose to deal only with the first, leaving the second and third to those who have actually been doing them, who therefore know the difficulties and the possibilities from actual experience, and are far more competent than I am to deal practically with the problems of collection and utilization.

I propose, gentlemen, to confine myself to what I shall call the Possibilities of Municipal Salvage.

The quantity of refuse which is "made" annually throughout the country I have estimated at 9,450,000 tons. This figure is based on an allowance of 15 cwts. per 1,000 of the population during 300 days in the year, a figure which is I think below the average of the amounts actually collected in most parts of the country. Whether we are justified in applying a figure obtained from the records of towns and cities to the country generally is a matter I shall deal with later, but I would just remind you here that it is the make of refuse which we are at present considering, and not its collection, and there is no apparent reason why the make of refuse should be any less in rural districts than in urban areas.

And now as to the nature and composition of this refuse. This I have based on actual results obtained by the authorities of Accrington, Bury, Hackney and Sheffield, each of whom have had a careful analyses made of bulk lots of ordinary refuse such as would have in due course been passed through the destructor. The following table shows the average results, and what they represent is applied to the refuse of the country generally:—

Analysis of "Refuse."

Commodity.	Analysis of refuse in Sheffield, Accrington, Hackney and Bury.	Applied to population Great Britain. assuming 15 cwt. per 1,000 population per day during 300 days annually 9,450,000 tons.		
Fine dust	50.98	4,817,610	say	4,800,000 tons
Cinders	39.63	3,745,035	say	3,700,000 tons
Bricks, pots, shales, etc. .	5.35	505,575	say	500,000 tons
Tins	0.98	92,610	say	90,000 tons
Rags	0.40	37,800	say	50,000 tons
Glass	0.61	57,645	say	50,000 tons
Bones	0.05	4,725	say	4,000 tons
Vegetable matter .. .	0.72	68,040	say	68,000 tons
Scrap iron ..	0.06	5,670	say	5,000 tons
Shells	0.08	7,560	say	7,000 tons
Paper	0.62	58,590	say	58,000 tons

These figures may appear to be somewhat fantastic, but I can assure you, gentlemen, that they are founded on facts and are within the bounds of reasonable possibility. Some of you may perhaps say, "The conditions in these towns or cities must be most unusual I am sure that my refuse is nothing like so valuable." Well, gentlemen, I can only advise you to go back home and make sure. Our first test was made in Sheffield, and the results surprised us, but when the results of the other three came in they all bore out the Sheffield figures. I may say further that several other authorities who have since at our request analyzed their refuse have obtained in every case at least similar and in some cases even higher results.

(Mr. Currie next proceeded to inquire what shipping tonage would be freed by the complete salvage of such materials as are at present being imported into the country.)

The figures which I have quoted must not be taken too literally, and we might not be justified in applying the possible ascertained salvage from the refuse of four large towns to the country as a whole, including all the small urban and rural districts from which one cannot hope to attain anything like the same results in the way of salvage work. This is no doubt true, but I am quite sure that far more can be achieved in such small urban and in rural districts than has been done in the past, if only combined efforts are made in the direction. Further, as a set-off against this consideration, we may put the fact that the analyses on which we have based our figures were made of refuse from which in some cases a certain quantity of paper, rags, etc., had already been extracted by special collections.

As comparatively few local authorities as yet collect separately, or sort their refuse before destruction or tipping our percentages for paper and rags at least is probably too low. I am inclined to think, therefore, that the figures I have given are within the mark as indicating the quantity of valuable materials at present being wasted, and if that is the case, they are the measure of the results which would be attained by complete salvage. This, of course, is too much to hope for under present conditions, but there is no harm in accepting the figures as ideals after which it is well worth striving with all the earnestness and energy at our disposal, and I shall have failed in my address to you today unless I have brought home to your minds, not only the possibilities, but the far-reaching results which can be obtained by combined and concentrated efforts in this direction. I am quite aware that all of you have many other duties of the utmost importance to perform, and that each one of you is probably doing double duty in some form or another. Nor do I forget the difficulties both as regards transport and labor with which your work is surrounded, but salvage work is necessary, and there are no others better placed or more competent to deal with its problems than the members of your institute.

Broken Stone for Road Construction

DIFFERENT classes of roads require more than one class of non-bituminous materials. Each type requires that best adapted to its particular classification.

During the summer of 1917 a survey was made of stone quarries in certain sections of the States with the primary object of obtaining data relating to the commercial sizes of broken stone, which would enable the Bureau of Public Roads to recommend a minimum number of standard sizes necessary for the various types of roads in which broken stone is used. It was found that within a very restricted area, revolving screens, with as many as 28 different size openings, were being used to produce broken stone for a comparatively few types of roads. As a rule, the exact size of product for any one type of road is selected by the individual engineer without refence to other products which the crushing plant may be called upon to supply, also without refence to what size or sizes the engineer himself will select for other types of roads. Moreover, great lack of uniformity in the method of specifying sizes of broken stone was found to exist so that the entire subject of broken stone specifications is at present in an almost chaotic condition.

The different size broken stone products which may be used satisfactorily in constructing various types of road are given in Table I. It will be seen that not more than five different size openings in revolving screens are required for any one type. In order to meet reasonable working conditions, a general tolerance of not less than 5 per cent. retained on the maximum screen, and 15 per cent. passing the minimum screen, has been allowed. In the case of screenings when only the maximum size of revolving screen would be required ordinarily, as the product would include dust and all other smaller material, from 40 to 80 per cent. of material passing the ¼ inch screen is specified. The only other exception is the broken stone for Topeka type bituminous concrete, where at least 20 per cent. of material is required to be retained on the ½ inch screen.

It is believed that the sizes here covered represent average practice and they are recommended for general use as a means towards standardizing not only specifications for broken stone but the production generally of broken stone for road work.

Table I.—Relation of commercial revolving screens to laboratory screen requirements for broken stone.

	Revolving screens.				
Type of road.	3-inch.	2-inch.	1-inch	½-inch.	¼ inch
	Per cent passing laboratory screen of same size.				
Water-bound:					
Bottom course	95+	15—	.....	.....	.....
Top course	.....	95+	15—	.....	.....
Screenings	.....	.....	95+	.....	40-80
or					
Base or both courses	95+	.....	15—	.....	.....
Screenings	.....	.....	95+	.....	40-80
Cover for bituminous surface treatment:					
Coarse chips	.....	.....	95+	.....	15—
or					
Fine chips	.....	.....	.....	85+	15—
Bituminous macadam:					
Bottom course	95+	15—	.....	.....	.....
Top course	.....	95+	15—	.....	.....
Chips	.....	.....	95+	.....	15—
Screenings	.....	.....	95+	.....	40-80
Bituminous macadam:					
Wearing course	.....	95+	15—	.....	.....
Chips	.....	.....	95+	.....	15—
Bituminous concrete:					
One-size stone	.....	.....	95+	.....	15—
Chips	.....	.....	.....	95+	15—
Graded bituminous concrete:					
Coarse aggregate	.....	.....	95+	.....	15—
Chips	.....	.....	.....	95+	15—
Bituminous concrete (Topeka):					
Broken stone	.....	.....	.....	95+	80—
Sheet asphalt:					
Binder stone	.....	.....	95+	.....	.....
Cement concrete pavement:					
Coarse aggregate	.....	95+	.....	.....	15—
Cement concrete base:					
Coarse aggregate	95+	.....	.....	.....	15—

In the construction of a broken stone road by the usual water bound macadam methods, no granite, sandstone, schist, gneiss, or quartzite should be used in the wearing course owing to the lack of binding qualities found in materials of this nature.

The top course stone should pass on 1 inch screen —100 per cent., on ¼ inch screen, 40 to 80 per cent. The bottom course should pass on 2-inch screen not less than 95 cent., the total passing 1½ inch screen 25 to 75 per cent. Retained on 1 inch screen, not less than 85 per cent.

The specification for stone to be used in the construction of water-bound base upon which some higher type of wearing course will be placed, should require 95 per cent. passing 1 inch screen, 40 to 80 per cent. passing ¼ inch screen, not less than 95 per cent. passing 3 inch screen, 25 to 75 per cent. passing 2 inch screen and not less than 85 per cent. retained on 1 inch screen.

Broken stone for bituminous surface treatment should pass not less than 95 per cent. on 1 inch screen, retaining not less than 85 per cent. on ¼ inch screen. It should be evenly spread at the rate of 1 cubic yard to every 50 to 75 square yards of treated road surface.

When the treatment of bituminous material is less than 1/3 gal. per square yard, not less than 85 per cent. should pass ½ inch screen and not less than 85 per cent. retained on ¼ inch screen. One cubic yard should cover from 50 to 100 square yards of treated road surface, depending on the amount of bituminous material which has been applied per square yard.

In the construction of a water-bound broken stone base, and a bituminous broken-stone wearing course constructed by the penetration method, not less than 95 per cent. should pass a 3-inch screen, 25 to 75 per cent. pass a 2½ inch screen and not less than 85 per cent. should be retained on a 2-inch screen.

The stone used in the construction of a bituminous broken stone wearing course, in which the bituminous material is applied by the penetration method, not less than 95 per cent. should pass a 1-inch screen and not less than 85 per cent. should be retained on ¼ inch screen.

In the broken stone, sand and filler for coarse aggregate bituminous concrete wearing course, not less than 95 per cent. of the stone should pass ½ inch screen and not less than 85 per cent. be retained on ¼ inch screen. For sand, 100 per cent. should pass ¼ inch screen, 30 to 70 per cent. passing 40 mesh sieve and not less than 95 per cent. retained on 200 mesh sieve.

The mineral filler consisting of limestone dust, dolomite dust, portland cement, or natural cement, should pass 100 per cent. on a 30 mesh sieve and not less than 65 per cent. passing 200 mesh sieve.

For "Fine aggregate bituminous concrete wearing course," not less than 95 per cent. of the stone should pass ½ inch screen and not less than 20 per cent. should be retained on ¼ inch screen; 100 per cent. of the sand should pass ¼ inch screen and not less than 90 per cent. retained on 200 mesh sieve; 100 per cent. of the mineral filler should pass 30 mesh sieve and not less 65 per cent. passing 200 mesh sieve. This specification is intended to cover a modified Topeka, or a stone-filled sheet asphalt type.

A binder course and sheet asphalt wearing course require broken stone consisting of angular fragments of rock.

The sand shall be composed of sound durable stone particles, free from a coating of clay and loam, which when tested shall all pass a ¼ inch laboratory screen.

The total mineral aggregate shall consist of a uniform mixture of the broken stone and sand, the required grading of each being such as to produce, when properly proportioned, a mixture conforming to the following limitations for grading. The exact proportion of each constituent producing a mineral aggregate within these limitations shall be as directed by the engineer.

When tested by means of laboratory screens and sieves the total mineral aggregate shall meet the following requirements:

	Per cent
Passing 1-inch and retained on ½-inch screen	15 to 65
Passing ½-inch screen and retained on 10-mesh sieve	20 to 50
Passing 10 mesh sieve	15 to 35

The sand shall be composed of sound, durable, angular stone particles, free from a coating of clay or loam.

When tested by means of laboratory sieves the sand shall meet the following requirements:

	Per cent.
Passing 10-mesh sieve	100
Total passing 10-mesh and retained on 40-mesh sieve	12 to 50
Passing 10 mesh and retained on 20-mesh sieve	2 to 15
Passing 20-mesh and retained on 30 mesh sieve	5 to 15
Passing 30 mesh and retained on 40 mesh sieve	5 to 25
Passing 40 mesh and retained on 50 mesh sieve	5 to 30
Passing 50-mesh and retained on 80 mesh sieve	5 to 40
Total passing 80-mesh and retained on 200-mesh sieve	20 to 40
Passing 80-mesh and retained on 100-mesh sieve	6 to 20
Passing 100 mesh and retained on 200-mesh sieve	10 to 25
Passing 200 mesh sieve	0 to 5

Mineral Filler for Sheet-Asphalt Wearing Course

The mineral filler shall consist of limestone dust, dolomite dust, Portland cement, or natural cement. It shall be free from foreign or other objectionable material.

When tested by means of laboratory sieves, the mineral filler shall meet the following requirements:

	Per cent.
Passing 30-mesh sieve	100
Total passing 200-mesh sieve, not less than	65

Broken stone for one course portland cement concrete pavement should pass not less than 95 per cent. on 2 inch screen, 40 to 75 per cent. passing 1 inch screen and not less than 85 per cent. retained on ¼ inch screen. The sand should be well graded from coarse to fine, 100 per cent. passing ¼ inch screen, 50 to 80 per cent, passing a 20 mesh sieve, not more than 20 per cent, passing a 50 mesh sieve and not more than 5 per cent. passing a 100 mesh sieve.

Not less than 95 per cent. of the stone or gravel for coarse aggregate should pass a 3 inch screen, 40 to 75 per cent. should pass 1½ inch screen and not less than 85 per cent. should be retained on ¼ inch screen. The sand for fine aggregate should pass 100 per cent. on ¼ inch screen, not less than 20 per cent. passing a 20 mesh sieve, not more than 50 per cent. passing a 50 mesh screen, and not more than 10 per cent. passing a 100 mesh screen.

The concrete should be mixed in a batch mixer for not less than 1 minute and the water should be reasonably clear, free from oil, acid, alkali, or vegetable substance, and neither brackish nor salt. Sufficient water should be used to produce a concrete which will flatten out and quake when deposited in place, but not enough to cause it to flow or to separate mortar and coarse aggregate.

The gravel for the base course of water-bound gravel roads should be composed of fragments of hard, durable rock, of high resistence to abrasion and should be free from thin or elongated pieces. Not less than 95 per cent. should pass a 3-inch screen and from 50 to 75 per cent. should be retained on a ¼ inch screen.

For wearing course, not less than 95 per cent. of the gravel should pass a 2 inch screen and from 50 to 75 per cent. retained on ¼ inch screen.

Gravel, sand and filler for coarse aggregate bituminous concrete wearing course should meet the following specification:—

The sand shall be composed of sound durable stone free from coating of clay or loam and 100 per cent. should pass ¼ inch screen, 30 to 70 per cent. passing 40 mesh sieve and not less than 90 per cent. retained on a 200 mesh sieve.

The mineral filler shall consist of limestone dust, dolomite dust, portland cement or natural cement, free from foreign or other objectionable material, 100 per cent. passing a 30 mesh sieve and not less than 65 per cent. passing a 200 mesh sieve.

Slag screenings for water-bound base should pass not less than 95 per cent. on 1 inch screen and from 40 to 80 per cent, passing ¼ inch screen.

Ninety-five per cent. of coarse slag should pass 3 inch screen, 25 to 75 per cent. passing 2 inch screen and not less than 85 per cent. being retained on 1 inch screen.

Natural sand, clay or top- soil, should be graded as follows:

Clay	10 to 25 per cent.
Silt	10 to 25 per cent.
Total sand	50 to 80 per cent.

Gravel.

Samples of pit run gravel proposed for use in water-bound gravel road construction should be taken at least 10 days and not more than 6 months prior to the date of acceptance or rejection, and, if from an accepted source of supply, whenever, during the progress of the work, the gravel appears to change markedly in either quality or grading. Great care should always be exercised in sampling a gravel pit to insure obtaining material for test which is strictly representative of that which it is proposed to use. A number of samples may be taken from a single pit if necessary to cover the probable range in grading of the available material. Samples of pit run gravel should weigh from 50 to 75 pounds.

Samples of screened gravel may be taken at the plant, from bins, storage piles, barges, or cars. A composite sample composed of samples from different parts of the supply is advisable in order to determine the average composition of the material. Every shipment of gravel for bituminous concrete or Portland cement concrete should be sampled, in which case no single sample should represent over 100 cubic yards. Samples should weight from not less than 10 pounds, for material containing fragments up to ¾ inch in diameter, up to 60 pounds, depending on the size of the largest fragments present.

Shipment of samples should be made in tight boxes or close-woven cloth bags.

Sand.

Before approving a source of supply, samples of sand should be taken at least 10 days prior to the date of acceptance or rejection. Pit samples should be taken only from freshly exposed surfaces, and the number of samples from any given deposit should be sufficient to cover the extreme range in quality of that porition of the deposit which it is proposed to use. Every shipment of sand for bituminous concrete, Portland cement concrete, or grouting should be sampled, and no single composite sample should represent over 100 cubic yards. Additional samples should be taken whenever the appearance of the sand changes. In the case of sand for sheet asphalt, frequent samples should be taken daily at the plant from the drum or bin.

Samples of sand should weigh approximately 10 pounds. They should be shipped in tight boxes, case, or close-woven cloth bags.

Mineral Filler.

Each shipment of mineral filler should be sampled. When shipped in bags a composite sample should be prepared from one sample taken from each 20 bags in the shipment. A 1-pound sample may be submitted for examination shipped in a tight box or can.

Total Mineral Aggregates.

When the grading of the total mineral aggregate for bituminous concrete or binder course is specified frequent samples should be taken daily at the plant from the drum or bin. Such samples should weigh approximately 10 pounds and if shipped should be placed in tight boxes or cans.

Sand-Clay or Top Soil.

Before approving a source of supply samples of natural sand-clay mixtures, top soil, sand, or clay should be taken at least 10 days prior to the date of acceptance or rejection. The number of samples from any given deposit should be sufficient to cover the extreme range in quality of that portion of the deposit which it is proposed to use. Additional samples should be taken whenever the appearance of the material changes. When an artificial mixture is made on the road fragment samples of the finished mix should be taken. Samples should weigh approximately 10 pounds and if shipped should be placed in tight boxes or cans.

Get More Heat Out of Your Winter Coal

In view of the universal coal shortage and the consequent wide-spread interest in conserving this commodity wherever and by whatever means possible, we feel justified in printing the following general suggestions on the operation of household heaters, as offered in a recent publication, "Fuel Facts," issued by the U. S. Fuel Administration:

How to get more heat out of your coal than the chimney does, is more important than any other branch of household economy. In the average home 25 per cent. of the coal used can be saved. Most of this saving can be accomplished by proper damper control. Tests have shown that only 40 to 50 per cent., on the average, of the heating value of the coal is usefully employed in heating a house or a building. Under conditions of proper installation and frequent and careful attention, 50 to 60 per cent. of the heating value may be converted into useful heat, while under unfavorable conditions only 25 per cent., or even less, of the heat value of the coal is utilized.

There is no more important general rule than the one emphasized by L. P. Breckinridge, of the Sheffield Scientific School of Yale University, to this effect:

The flow of air through the fuel makes it burn. Learn to control it. Try to visualize this flow of air through the fuel and you will easily learn how to operate the dampers to control it properly . . . The draft of the chimney is much diminished when by opening the check-damper cold air is allowed to flow directly into the chimney.

Save, to Help Win the War.

The Fuel Administration's first charge to the householder is cleanliness. To get the most heat from the least amount of coal his heater must be clean. One one-hundredth inch of soot has the same power to resist heat as ten inches of iron.

The Fuel Administration asks the head of each household to care for his heater himself this winter; to learn how to run his heater intelligently; how to get from every ton of coal every unit of heat it can supply to his family.

Give your heater its first cleaning of the season in the late summer and have it put in thorough repair. Broken parts mean loss of heat. The fire-box should be tight. Trivial cracks may be cemented.

Following are fuel savers and comfort suggestions, assembled briefly in the form of practical rules for operating the various types of household heating systems:

General Rules.

1. Be sure there is a check draft-damper in the smoke-pipe, besides the turn-damper. This check draft-damper is as important in controlling the rate at which the fire burns as is the throttle of an engine. Open it to check the fire. Close it to make the fire burn more rapidly. Experiment with it in the daily regulation of your fire. Make it do its work. The coaling-door was not put on the heater to check the draft. If you cannot check the fire without opening the coaling-door, you need proper dampers.

2. The turn-damper should fit the smoke-pipe loosely and must never be entirely closed. With the average plant it may be kept partly closed most of the time in mild weather, but during severe weather it usually needs to be opened wide.

3. Make use of the lift or slide-damper in the coaling-door only to let oxygen in to consume gases, if you are using soft or bituminous coal after fresh fuel has been added.

4. Just enough draft and that from below, checking the draft by letting more air into the smoke-pipe, is one of the best general rules. This furnishes oxygen from below, necessary for the consumption of the coal gases, and at the same time gives time for them to be consumed before being drawn up the chimney. This method also avoids escape of coal gas into the cellar. To make the fire burn more rapidly, do not open the whole ash-pit door, but only the draft-damper in the ash-pit door. Opening the whole ash-pit supplies air to the fire faster than it is needed for combustion. The air is heated, passes out of the chimney and is so much heat wasted.

5. All heat pipes in the cellar should be thoroughly and completely wrapped with asbestos or similar covering to prevent loss of radiation.

6. Grates should be cared for properly. A short, quick stroke of the shaker handle will sift the ashes through the grates. Leave grates in flat position when through shaking. Clean ash-pit daily, to prevent damage to grates. In severe weather grates should be shaken until a glow appears in ash-pit. In moderate weather a bed of ashes should be carried on top of the grates.

7. Avoid poking and slicing fire-bed. It causes draft holes and clinkers.

8. Never shake a fire that is low until you have put on a little fresh coal and given it time to ignite. A thin fire wastes coal. Disturb the fire as little as possible.

9. Storm-windows and storm-doors, weather-strips and such protective devices are economical of heat.

10. Keep the temperature of sitting-rooms at sixty-eight degrees or less. If there are invalids, old folk or very little children in the family, the temperature may be higher. Rooms where you do not sit are more comfortable if much cooler, as a rule, providing the air is kept a little moist. Get a thermometer—a good one. Use it inside, not hanging outdoors.

11. It is wasteful to allow the temperature to drop way down at night. It takes twice as much coal to heat it up again next morning.

12. Turn off the heat in unused rooms whenever possible. Bedrooms should be kept much cooler than living rooms. Don't try to heat all the rooms all the time. If you have a hot-water system, make heavy radiator slip-covers and put them over radiators when not in use. This will prevent freezing.

13. Always keep two pans or open-top jars of fresh water on radiators or in front of registers to keep the air in the home moist.

14. Study the Specific Rules applying to the system of heating in your house.

Hot-Air Furnaces—Specific Rules.

1. Provide cold-air drops from upper floors so as to insure a return circulation from all rooms to the air intake of the furnace.

2. Regulate the window of the cold-air box so as to avoid too great a current of outside air, especially on very cold days.

3. Always keep the water container in the air-jacket filled with clean water. Moist air heats much more readily than dry air, and is better for health, as well as more comfortable.

4. It is advisable to keep a jar of water near one of the first-floor registers that sends out the most heat. Change the water frequently, preferably every day

5. Hot-air pipes should have a good pitch upward from the furnace, and should be of sufficient diameter. They

should also be wrapped with sheet asbestos. A separate pipe for each room with a turn damper near the furnace is a good rule. Each pipe should be labeled, so that certain rooms can be shut off at the furnace when desired.

6. Be sure the fire-box is gas-tight. All cracks must be thoroughly cemented or a new section put in before winter sets in. Otherwise coal-gas will escape into the air-jacket and be carried up directly to the rooms.

7. Study carefully the General Rules pertaining to other types of heating-plants as well as your own. Notice the "clean-out" door and remember why it is there.

Steam Heaters—Specific Rules.

1. The water in the boiler should be completely changed at least as often as every spring and every autumn. Draw a bucketful of dirty water from the bottom at least twice a week and each time replenish with fresh water from the supply-pipe. Cleanliness of water in the boiler is of prime importance.

2. Look at the glass water-gauge whenever you attend to the fire. Turn the exhaust-cocks above and below the gauge occasionally to make sure that it is not clogged or the openings to it from the boiler closed up. They must be kept open.

3. The level of the top of the water must always show at some point along the gauge. Its height will vary with the temperature of the water; but if it rises about the top of the glass there is too much water in the boiler and some must be drawn off; and if it sinks below the bottom of the glass some more water must be let into the boiler.

4. Be sure that the exhaust-valve of each radiator works. Sometimes these valves need cleaning with a pin or soaking in kerosene. If in doubt about one of them unscrew it from the radiator when the fire is low and there is no steam-pressure, or else after turning off the radiator. If you can blow through it, it is all right. If not it must be cleaned until you can. Don't fail to replace it. It is advisable to have an extra valve to replace any one that is temporarily out of order.

5. Don't fail to study the General Rules, applicable to all heating-plants, and also to keep the boiler-flues clean.

Hot-Water Plants—Specific Rules

1. All the water should be emptied from the plant and clean water put in at least as often as every spring and every autumn.

2. When the first fire of the season is built, as the water gets heated, take the raidiator key and open up the exhaust-valve of each radiator in turn until all the air remaining in each radiator is allowed to escape. Repeat this operation occasionally to make sure there is no air interfering with free circulation of the water.

3. Always be sure that water shows in the glass gauge of the exhaust tank, which is usually located in the top story of the house above the level of the radiators.

4. Be sure the boiler is covered with asbestos, as well as the pipes in the cellar.

5. Study carefully the General Rules relating to all types of plants. Keep heating surfaces of the boiler well cleaned.

The Kitchen Range.

1. Avoid too much shaking. Live coals in the ash-pit mean wasted fuel. Clean ash-pit daily to prevent damage to grates.

2. Clean the entire stove well inside, on top of the oven and below the oven, frequently and thoroughly.

3. Stoke frequently and in small amounts.

4. Never shake a low fire until a little fresh coal has been added and given time to ignite.

5. Keep a pan or kettle of water always on the kitchen stove. Moist air makes for comfort, health, beauty and economy.

6. Read the General Rules applying to all household coal-burners.

Advantages of Moist Air in Rooms.

As humidity of the atmosphere controls the distribution of the sun's warmth upon the earth, so does moisture in the air of the home have a controlling influence upon its comfort. If the air in a room is dry, the heat from stove, register or radiator, strikes through this dry air readily, and, without being absorbed, rises quickly to the ceiling; while if the air is moist the heat is absorbed and the general temperature of the atmosphere of the room is perceptibly raised.

Clouds have a cooling effect on a hot day because they are masses of moisture, absorbing heat from the sun's rays before it reaches the earth.

While a damp climate is enervating in hot weather and biting in cold weather, nevertheless, a moderately moist atmosphere in the temperate warmth of the living rooms adds to comfort and works for economy and health. The air of heated rooms is nearly always too dry.

In dry air the evaporation from skin, throat and lungs is increased; illustration of this is the fact that woodwork and furniture usually swell when exposed to the natural summer atmosphere, while they shrink and crack in heated rooms in winter.

It is advisable to keep a bowl or open jar or two of fresh water in each heated room, giving the air a chance to absorb moisture from them rather than from your body and the furniture.

Mainly Constructional

East and West—From Coast to Coast

The Canadian Cartridge Co. has begun the construction of an addition to its plant on Sherman Ave., North, Toronto, to cost $40,000.

The Reid-Newfoundland Co. will erect at St. Johns, Nfld., a large cold storage plant, with a present capacity of 12,000,000 lbs. of fish, to be enlarged to a capacity of 50,000,000 lbs. later.

The site of the buildings to be erected on the Manitoba provincial prison farm has been selected, and plans will be prepared to permit of the commencement of the construction work next spring.

The Peter Lyall Shipbuilding Co. is planning to make extensions to its large plant at the foot of Bewicke Ave., Vancouver, including the utilitzation of the street ends of Bewicke and Fell avenues and the construction of a wharf out from the end of the fill at the foot of Bewicke.

Messrs. Armstrong & Morrison, of Vancouver, have been awarded the contract for the construction of a bridge across the Similkameen River on the Copper Mountain Branch of the Kettle Valley Ry. It will have two spans, one of 150 ft. and the second of 100 ft.

The city council of Sault Ste. Marie, Ont., have received the sanction of the Minister of Finance for the expenditure of $55,500 on the erection of the proposed new wing to the Central School, which will house the domestic science and manual training department of the public school work.

About 100 men are working on the new extension of the Canadian Government Railway at South Devon, N.B., between South Devon Station and Marysville on a portion of the road near Barker's point. The road bed is being made wide enough to allow five tracks abreast, in addition to the main tracks already in use. The additional tracks will be used for yard purposes.

Mr. F. A. Dallyn, engineer of the Ontario Board of Health will accompany the Canadian Expeditionary force to Siberia, being placed in charge of the water supply.

An application has been made to the Quebec Government for authority to build a dam across Back River for the purpose of developing power. This will interfere, it is alleged, with the City of Montreal's drainage system, and the Administrative Commissioners have made a protest to the Quebec Government against the project.

Parkill & Hanson, Limited, is the name of a recently organized firm of power and fuel engineers in Winnipeg. Mr. J. H. Parkhill is the president; Dr. R. D. McLaren, of the University of Saskatchewan, is the consulting chemist; and Mr. E. A. Hanson, who for a number of years was electrical engineer of the city of Saskatoon, is the engineer of the new concern.

The council of Welland, Ont., have decided to strengthen the bridge over the Welland River on North Main street, providing that the Lake Erie Ry. Co., pay one-third of the cost of the work and also agree to extend their railway service over the bridge to the Sixth Ward.

A new mill, of the most modern type and designed to treat about 150 tons of ore daily, will be built at the Wright-Hargreaves Mines, Kirkland Lake, Ont. This property is crossed by the auriferous zone, which has been proven from the Tough-Oakes west as far as the east boundary of the Elliott-Kirkland, a distance of upwards of two miles, and high grade ore has been developed to a depth of 400 ft.

Steel on the Kettle Valley Ry. branch line is to be laid as far as Mill Site, where the Canada Copper Corporation have a $500,000 concentrating plant under construction, by November 1st. The line is to be finished to Copper Mountain, 18 miles south of Princeton, by the middle of next summer. It is at Copper Mountain that the Canada Copper Corporation anticipate spending millions during the next decade in mining huge depositis of low-grade copper ore. Development work has now been carried on to the point where little more need be done until the railway is built to bring down the ore.

Connection had been made in the tunnelling under the Red River, which is to provide passage for the Winnipeg Aqueduct. Haste is also being made to make all other connections that may be necessary throughout the system, so that in a short time the Greater Winnipeg Water District will be supplied with water through its big concrete duct.

The Chatham Board of Trade is strongly in favor of having the provincial highway pass through that city from London and eastern points on to Windsor. A special committee has been appointed to act in co-operation with a special committee of the city council to consider draft plans of the territory through it is suggested the highway will run west of the city.

Mayor F. H. Davidson, of Winnipeg, recently laid the corner stone of the well-house at St. Boniface for the reception of the Shoal Lake water supply. This well house, which is under construction, is practically the only piece of the Winnipeg aqueduct which is above ground and presented the first opportunity for such a ceremony. A sealed box containing current coins of the realm, the day's newspapers, plans of the aqueduct and also its details were stowed away in the cavity of the stone. The well house, which is situated at the entrance to the tunnel under the Red River, will be for the purpose of regulating the water supply and will enable any surplus flow to be side-tracked into the river, a special outlet being placed in the stream to avoid any swirl that would endanger navigation. It will be the only check on the mains, excepting for the entrance gates at the intake on Shoal Lake, and should there be any accidental bursting of any piping, it will permit the total flow to be diverted into the river.

Personals

Mr. Richard Wright, who has been Assistant Chief Architect of the Department of Public Works for a number of years, has been promoted to be Chief Architect, taking the place of Mr. E. L. Horwood.

Mr. Robt. Grant, who for a considerable time has been with the McIntyre-Porcupine mines at Porcupine, has, it is understood, been engaged to design and ultimately supervise the construction of a mill at the Wright-Hargreaves Mines at Kirkland Lake.

Lieut. C. C. Thompson, of the architectural firm of Banigan, Mathers & Thompson, Toronto, who, since recovering from his wounds a year ago, has been aide de camp to Major-Gen. Garnet B. Hughes, has returned to Toronto from overseas. Mr. Banigan of this same firm is attached to the British War Mission in the management of the Commercial Solvents Corporation at Terre Haute, Indiana.

Lieut.-Col. Colin Ramsay, C.M.G., of Montreal, last week was married in London to Miss Dorothy Jackson, youngest daughter of Sir John Jackson, M.P. of the well known British contracting firm. The Canadian Branch is known as Sir John Jackson, Canada, Ltd., and has a office in Montreal. Lieut. Col. Ramsay was for many years in the railway department of the C.P.R., as engineer of construction of Eastern lines. He organized the Canadian Railway Construction Corps, of which he was in command. The corps did splendid work, and Lieut. Col. Ramsay was created C.M.G. in recognition of his services. He is now on the staff of the railway department of the War Office, London.

Lieut-Col. C W. P. Ramsay

Obituary

Mr. W. C. Power, manager of sales, Wallaceburg Brass & Iron Mfg., Co., Wallaceburg, Ont., died on August 17.

Mr R. R Bangham, former Street Commissioner and Alderman, of Windsor, Ont., and more recently manager of the Ontario Asphalt Block Co., died at his home on Sept 19 at the age of 66 years.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Penticton, B.C.
Work is to start soon for an irrigation system costing $35,000 for the Town Council. Engineer, McKeever.

Rosthern, Sask.
Town Council contemplates the construction of a sewage disposal plant costing $15,000. Mayor, R. S. Fleury.

Summerland, B.C.
Town Council contemplates the construction of a pipe line. Chairman, Councillor Johnston.

CONTRACTS AWARDED

Brampton, Ont.
Sewage disposal plant costing $11,055 for the Town Council: General contractor, G. C. Reid, 23 Earlscourt Ave., Toronto.

Ste. Therese, Que.
Macadamizing four miles of roadway for Town Council: General contractor, Arthur Blanchard.

Railroads, Bridges and Wharves

Alberni, B.C.
Tenders are being received by the Department of Public Works, Victoria, until noon, October 9th, for erection of bridge. Engineer, A. E. Foreman, Victoria.

Drumheller, Alta.
Work has started constructing road and laying heavy steel tracks thirteen miles for C. N. Rly., Toronto, Ont. Engineer, A. T. Fraser, C.N.R. Station, Edmonton.

Edmonton, Alta.
Work is to start for three steel bridges for C. N. Rly., Toronto. Engineer, A. T. Fraser.

Hanna, Alta.
Work has started on railroad construction for C. N. Rly., Toronto. Engineer A. T. Fraser.

Vercheres, Que.
Tenders are being received by R. C. Desrochers, secretary of Department of Public Works, Ottawa, until noon, October 15th, for reconstruction of wharf superstructure and repairs to wharf approach.

CONTRACTS AWARDED

Ottawa, Ont.
Storage building costing $4,000 for C. P. Rly. Co.: General contractor, P. Ellement, 624 Cooper St.

Rainy River, Ont.
$30,000 station for the C. N. Rly., Winnipeg: Plumbing and heating, J. Dowd Co., 735 Corydon Ave., Winnipeg; cut stone, Tyndall Quarry Co. Ltd., 1591 Erin St., Winnipeg.

Swift Current, Sask.
Stock yard costing $12,000 for C. P. Rly., Montreal: General contractor, Carter-Halls-Aldinger Co., 503 Union Bank Bldg.

Walkerville, Ont.
Excavating has started for a $12,000, one storey, brick round house for Essex Terminal Railway: General contractor, Thompson Bros., Huron & Erie Bldg., Windsor. Steel, roofing and electrical work to be let.

Public Buildings, Churches and Schools

Brantford, Ont.
By-law is to be voted in January for $75,000 for the construction of a school for the Board of Education. Chairman, J. W. Shepperson, 105 Chatham St.

Calgary, Alta.
Tenders are being received by R. C. Desrochers, secretary of Department of Public Works, Ottawa, until noon, October 12th, for construction of service building, surgical building, active treatment wards, administration building and convalescent wards.

Cardston, Alta.
Work is to start this Fall for a $3,000 school for Butte Lake S. D. Secretary, H. Nelson.

Langley, B.C.
School Board contemplate the erection of a high school costing $7,500. Secretary, F. MacPherson.

Ottawa, Ont.
Work is to start for a $6,000 addition to rectory for St. Mary's Rectory, Bayswater Ave. Architect, L. Villeneuve, 100 Bayswater Ave.

Rosthern, Sask.
School Board contemplate addition to school costing $20,000. Secretary, George Braden.

Wolseley, Sask.
By-law has been voted on September 30th, for the construction of a white brick addition to school costing $7,500 for the School Board. Secretary, A. B. Hill.

CONTRACTS AWARDED

Avonlea, Sask.
Addition to school costing $6,000 for Avonlea School Board: General contractor, Frank Rooney, Weyburn.

Brantford, Ont.
$3,500, one-storey, brick church for Seventh Day Adventists: Excavating, Wm. Holder, 264 Wellington St.

Chatworth, Alta.
Work is to start at once for a school for Chatworth S. D. No. 3516: General contractor, Alex. Eason, Vermilion.

Fort William, Ont.
One-storey, frame church costing $5,000 for the Greek Church: General contractor, R. E. Wright, 318 Franklyn N.

Halifax, N.S.
Testing building for Department of Public Works, Ottawa: General contractor, M. E. Keefe Construction Co. Ltd., McFatridge's W.

Glebe house costing $8,000 for St. Joseph's Church, Russell St.: General contractor, Eastern Investment Corporation, Cragg Bldg., will let plumbing, heating and electrical work.

Kamloops, B.C.
Addition to sanitarium for King Edward Sanitarium Board: General contractor, Dominion Construction Co. Ltd., 509 Richards St., Vancouver.

London, Ont.
Hospital building for Department of Public Works: General contractor for two buildings, A. B. Coleman, 1609 Queen St. W., Toronto; one building, Bate, McMahon Co., Central Chambers, Ottawa; one building, Canadian Contractors & Builders Ltd., Brockville.

Montreal, Que.
Church costing $143,000 for Parish of Notre Dame De La Dedece: Plumbing and heating, Napoleon Turcot, 1600 St. Lawrence Blvd. Prices wanted now on painting, glazing and electrical work.

Repairs to court house costing $14,000 for Department of Public Works, Quebec: Masonry, carpentry and general contract, Lacroix & Vezeau, 317 La Brecque St.; marble and tile work, Emile Lepage, 32 St. Vincent St.

Morden, Man.
Alterations to lands titles offices costing $14,000 for Department of Public Works, Winnipeg: Plumbing and heating, Standard Plumbing & Heating Co., Fort St., Winnipeg.

Ottawa, Ont.
Pipe bents, coal and ash handling equipment for the Department of Public Works, Ottawa: Structural steel pipe bents costing $6,410, the Canadian Agency & Supply Co., Butterworth Bldg.; coal and ash handling equipment costing $20,037, Canadian Link-Belt Co. Ltd., 265 Wellington St. W., Toronto.

Ste. Anne De Bellevue, Que.
Hospital building for Department of Public Works, Ottawa: General contractor, E. G. M. Cape & Co., Ltd., 10 Cathcart St., Montreal.

Toronto, Ont.
Temporary barracks costing $300,000 for Department of Public Works, Ottawa: Plumbing and heating, W. G. Edge Ltd., Booth Bldg., Ottawa. General con-

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The Songs of a Sore-Head

JEALOUSY and petty spite dominate" the Dominion. "A man who can hold a responsible position for two years is a rarity." And the climate—"Well, I for one, soon got out, thank God."

This is the strain of what is apparently a series of letters appearing in "The Plumber," and similar magazines in England, written by a Mr. S. Barlow Bennett. Evidently he does not like Canada and he is going out of his way to lay the blame on Canada. This gentleman's attitude of mind towards us may be gathered from the following extracts from one of the letters mentioned above. It is dated from Colorado, U.S.A., July 23rd, 1918:

"In the towns and cities of Canada, whether large or small, it is important that it should be known that it is an annual occurrence to "fire" some of the municipal officers. There would be no "sport" in the elections if the politicians were to be deprived of this, their accustomed privilege.

"Jealousy, petty spite, and a determination "to get" at somebody, dominate the whole of the elections.

"A man who can hold a responsible position for two years is something of a rarity. Let me warn any municipal official in England from emigrating, if he thinks of obtaining or being able to hold a similar position in the Dominion of Canada. As to security of position, it is a complete farce. I know of a municipality—no names, hush—where the Council "fired," i.e., asked to resign, the Municipal Clerk, the Fire Chief,, the Medical Officer of Health, the Chief of Police, and the Waterworks Superintendent, all at one sitting.

"Again, I know of another case where, after the elections, every man employed by the municipality got notice to quit, even the Magistrate. Fortunately, however, for him, he was under the jurisdiction of the Provincial, and not the Municipal Council.

"Then these wise "guys" went into Committee, and as each one had some one he wanted to fire, they had to compromise with one another. "You vote to 'fire' my man and then I'll vote to get your man in" or out, as the case might be. This not only goes on with municipalities, but even with the Provincial Councils. They "fire" everyone, from the Chief Engineer to the Chinese janitor. In another province, when the election campaign began, some of the members of the party in power went the round of the offices touting for subscriptions to the party funds. Of course, if the official wanted to keep his position, why, he subscribed accordingly, of course.

"Let me conclude by saying that there is no place in the world to emigrate to like Canada—except England."

An editorial in the same issue says the author of this letter was at one time a "successful engineer to several Canadian municipalities."

Now isn't it unfortunate that the name of this "successful engineer" coincides so absolutely with that of a plumber who came from the old land several years ago (from Durham, if our information is correct), moved about a good deal, and finally left a certain western town—to quote a Utilities' Commissioner of the town—with a reputation that was "most unsavory?"

"The Plumber," of course, could scarcely be aware of the existence of this double of the Mr. S. Barlow Bennett of their acquaintance—the successful engineer—and so, to make it perfectly clear that these two gentlemen cannot possibly be the same—in justice to the successful engineer—we give the information above. We have further heard that once upon a time our Mr. S. Barlow Bennett—the plumber—essayed to accept a job as engineer to a small western town, and among other things undertook the purchase of supplies for certain municipal work, and that some $30,000 worth of pipe lies rusting on the streets to-day because he made a "slight error" in computation. For this and other things, it is said, he was "fired."

Now it may be just possible that the Mr. S. Barlow Bennett, the successful engineer, who is writing these letters, had heard by chance of this case, and he may indeed have had it in mind when he wrote the letter from which we print the extracts above. Indeed it seems fairly certain that such must be the case, because there are very, very few incompetent officials in our engineering departments in Canada, and, in consequence, the practice of "firing" is as rare as it is unnecessary.

We cannot but think, however, that "The Plumber" was culpable in not making it somewhat clearer to its readers that the Mr. S. Barlow Bennett, the successful engineer, and the Mr. S. Barlow Bennett, the plumber who was fired for over-purchasing pipe to the extent of $30,000 in a small municipality, could not, of course, be the same man.

British Shipbuilding

SPEAKING to the shareholders of R. and W. Hawthorn, Leslie and Co., Limited, on Monday last, the chairman, Sir Herbert Rowell, said that "The enthusiasm of the workers in America, resulting in the rapid development of shipbuilding in the coastal States, where it is a new industry, must command our admiration, but it should also inspire and foster a spirit of serious emulation amongst British workers, as the ultimate effect of this new source of production on our industry demands our consideration. At the same time it should be realized that the publicity given to American achievement and the state of comparative ignorance in which the British public has been kept as to British achievement has given entirely false impression that with us this most important industry is decadent. The truth is, apart altogether from repairs—a branch of the industry which has from the nature of things increased enormously during the war—new construction in this country, taking both naval and mercantile together, has been during these war years half as much again as during the best year of peace. This, expressed in terms of output of merchant shipping, would, I estimate, be equal to about 3½ million gross register tons per annum, a record of which the country may well be pround. If, however, the necessary skilled labour had been returned from the Army, as could well have been done in view of the arrival of the American forces, and adequate unskilled labor supplied, the output of 3 million gross register tons indicated to the shipbuilders as necessary to meet the submarine menace would undoubtedly be produced in addition to the warship work in hand."—The Engineer.

The Technical Man's Salary

THE scientific and engineering professions have the poorest organization of any of the professions in Canada. The work of the engineer, as a rule, necessitates frequent and, very often, extensive travel from one part of the country to another. Men of other professions, such as the legal or medical, are able to settle more or less permanently in one place, which is usually a large centre of population. This affords them a much better opportunity of meeting together, which is the first requisite of strong organization. There is a well maintained professional etiquette in these professions, which assures the regulation of fees for service. The fees they demand and receive maintain the dignity of their professions. Engineers are very often paid less for their brains than unskilled laborers are paid for their muscle.

The crux of the whole matter is that ordinary labor, requiring little special training and only average intelligence, has become so thoroughly organized the whole world over that it is in a position to demand its own estimated value for its services. The technical man, whose knowledge has been acquired only at considerable expense and years of training, is at a discount through lack of organization and lack of, so-called, professional etiquette. The salvation of the engineers rests mainly with themselves.

In the July bulletin of the Canadian Mining Institute, an instance is cited where the Civil Service Commission of Canada advertised for a legal officer at an initial salary of $3,300 per annum, and for a chemist for the mines branch at an initial salary of $1,600. The required qualifications of the latter could only have been secured by years of post-graduate work. The duties of the legal officer could, however, be readily performed by any mediocre lawyer, or even by a clerk who had a few years' experience in a lawyer's office. This is only one instance of the government's estimate of the value of the services of a man with a high technical training. The Civil Service Commission's advertisements, which appear from time to time in the Canada Gazette, are evidence of the truth of this assertion. A technical clerk was required in the Topographical Surveys Branch of the Department of the Interior at a salary of $1,300 per annum. It is stated that "applications will be considered from graduates in Applied Science, Honor Mathematics or Physics, of some recognized university." By way of contrast, a "motion-picture camera man" required by the Department of Trade and Commerce, is to be given an initial salary of $2,400 per annum, and a law clerk an initial salary of $2,100.

There is something radically wrong with the system under which a university graduate, after four or more years of special study is expected to accept a position at a salary of $100 or so a month, whereas a man with only one or two months training can easily obtain work which is almost purely manual labor at $5, $10, or even more, per day. Education for its own sake is a fine ideal, but there are few men so altruistic that they do not look upon their education as a means to an end, as an investment, which will yield dividends in the shape of a future salary.

Intensive Shipbuilding

IN recent months the submarine sinkings have averaged less than 300,000 tons a month, and the total loss for 1918 will probably be less than 4,000,000 tons. When the Germans were sinking vessels at the rate of 8,000,000 tons a year, as they were in the early months of 1917, it was estimated that in order to be on the safe side, America should produce more than 10,000,000 tons of ships annually, and new shipyards were constructed to provide for such an output.

The development of the fabricated steel ship industry has been responsible for the doubling and, in many instances, doubling again of the estimated output of the American shipways. As stated in Engineering and Contracting, a 3,500-ton ship was constructed in 14 calendar days, and a 12,000-ton ship in 30 calendar days. These are records of rapid construction never dreamed of before the war. A destroyer, the "Ward," was launched in 17.5 days, and was in commission 71 days after the keel was laid. Formerly it required two years to build and equip a destroyer; so the "Ward" was turned out in one-eighth the time that was considered necessary prior to the war. Up to the present, the launching of the 12,000-ton "Invincible," in 24 working days, or 30 calendar days, is, we believe, the most remarkable speed record ever made in steel ship construction.

It was estimated that the 750 American shipways should each average one ship every four months; but it has now been demonstrated that it is practicable to deliver a steel ship a month from each way. Since the ships will average 6,000 tons each, it follows that America could produce 54,000,000 tons of ships in 1919 were every ship yard to average a ship a month per way. This would be one-fifth more than the entire merchant marine tonnage afloat in the world to-day.

Toronto's Union Station Nears Completion

A Complete Description, with Progress Illustrations, of this Fine Building—In Spite of War Conditions Good Progress Has Been Made—Stonework Constitutes a Canadian Record

SINCE the last progress report in the Contract Record, of the construction work in connection with the erection of Toronto's new Union Station, the work has reached almost the final stage. To the man on the street the imposing building seems about ready for occupation, but much interior work remains to be done, and the architects report that it cannot be ready before March, 1919. In our previous articles covering this work, we dealt chiefly with the details of construction in hand at that time. The present article brings the construction work up to date, and our illustrations refer to the various stages from the beginning of the foundation work to the present month.

Before work of any kind was started on the site, test borings were made by Smith & Travers, of Sudbury, Ont. The borings were made in November, 1915, and the following equipment was used: International pump, No. M 114, steam piston, 4½ in. x 2½ in. x 4 in.; "Sullivan S" drill, and Brotz diamond. The diameter of the casing was 2½ in., and the core 1½ in. The borings were made substantially on a line running diagonally from the south east corner to the north west corner of the building. The test boring diagram reproduced herewith shows at what elevations the rock layers were found, also the thickness of the various layers of rock. In view of the following report, loading tests were considered to be unnecessary, and tests for settlement under load were not made.

Ottawa, Dec. 31, 1915.

Dr. Eugene Haanel, Director, Mines Branch.

Memorandum re samples of borings from foundation of new postal station at Toronto. Submitted by E. L. Horwood, chief architect.

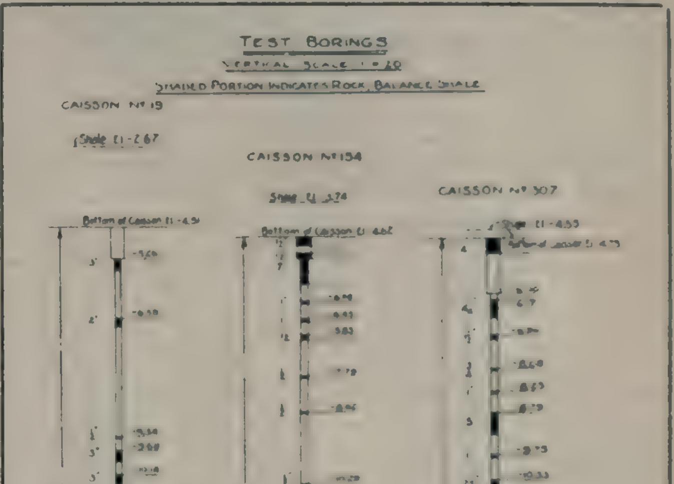
These sample borings are representative of the Lorraine formation which forms the bedrock under the city of Toronto and its suburbs.

The Lorraine formation in this locality consists of alternating, flat lying beds of compact grey shale, thin sandstone layers, and an occasional band of limestone. It is generally overlain by a varying thickness of stony, glacial clay.

The formation, as a whole, is dense and compact when in place, but the shale bands soon disintegrate and crumble a short time after being dug and exposed to the air. One of the samples is an impure limestone, the remainder are hard clay shale or argillite.

When excavating pits to bedrock, the upper layers of the latter are sometimes found to be distributed or tilted and mixed with clay or gravel. Shortly after this disturbed zone is penetrated the solid flat-lying formation should come into view.

For foundations on this bedrock it is preferable to excavate the material to a depth of a few feet below the solid surface before placing the footings. One of the hard sandstone layers will form a good basis on which to start work.



Test Boring Diagram

The Lorraine formation at Toronto will safely

Toronto Union Station in early stage of construction—from north west corner.

carry any weight of superstructure with proper footings, that it is desired to place upon it.

The best examples of heavy loads on this formation are the Royal Bank Building, on the corner of King and Yonge streets, and the new high level viaduct over the Don Valley at Bloor street.

Respectfully submitted,
J. Keele.

Crushing Tests—Shale.	Test No. 1	Test No. 2
Area in sq. inches	63.12	28.62
Crushing load in lbs.	218,000	166,000
Crushing strength—lbs. per sq. in.	3,510	5,800

R. J. Marshall,
Faculty of Applied Science & Engineering, University of Toronto, Dec. 3rd, 1916.

Analysis—Shale.

Acid Insoluble (Silica, etc.)	80.30 %
Oxide of Iron and Alumina	8.20
Calcium Carbonate (Lime)	3.90
Magnesium Carbonate	3.78
Combined Moisture & Organic Matter	3.50
Undetermined	0.32
	100.00 %

Note: The sample for analysis represented what appeared to be the solid shale formation, consisting of a fine grained compact rock and free from stratification. Sample was free from clay and any over-burden material.

The analysis represents a well-formed silicate of alumina and possible magnesia. The greater portion of the alumina and magnesia being insoluble in acid and being combined with the acid insoluble.

Thos. Heys & Son.
(By Chas. H. Heys, Jan. 14, 1916.)

Waterproofing.

No difficulty was experienced during the work of excavation. The caissons were carried down to shale at an average elevation of—3.6. The datum used was the mean lake level. The caissons run from 4 ft. 0 in. x 4 ft. 0 in. up to 6 ft. 6 in. x 6 ft. 6 in. in size, and the piers are splendidly lined up and finished. The subbasement is carried down to elevation—2.0. Some difficulty due to water was experienced, but as this condition was due to seepage only, it was overcome by water-proofing the wall with Barrett Felt and specification pitch. To-day there is no sign of any wall leak or seepage, which is good evidence of the success of the method employed. The foundation walls are all of concrete, and they are carried up to grade at elevation 8.6. The walls show the value of good form work. They are plumb and true throughout, well lined up, and the concrete is dense, hard and exceptionally well finished. The column footings and piers are circular in shape and vary from 4 ft. 0 in. to 6 ft. 6 in. in diameter. The lowest footing is carried to elevation—16.50.

The columns are broad flange H-sections located at 26 ft. 0 in. centres east and west and 22 ft. 0 in. centres north and south. They are wrapped with expanded metal, and fireproofed by means of poured concrete, making a much better job than that of plastering, which is usually employed.

Steel frame work before placing floors.

The walls are of Indiana limestone, as described in a previous article, backed up with the National Brick Co's. wire cut brick laid in cement mortar.

The ground or main floor is a beam and girder type floor. The girders are 20 in. I-sections, at 59 lbs., and the beams are 12 in. I-sections, at 31.5 lbs., spaced at an average of 5 ft. 0 in. on centres. The floor slab is of reinforced concrete 5-in. thick, and is reinforced with round steel rod reinforcement. It is designed for a live load of 200 lbs. per square foot.

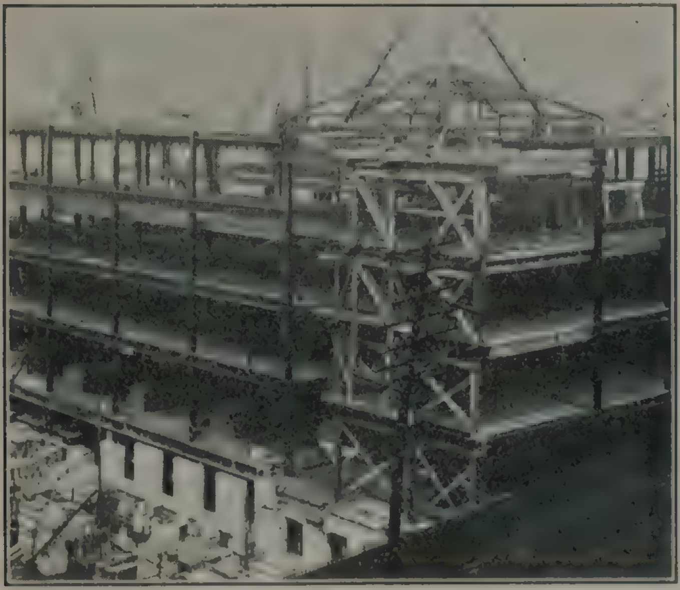
The second floor is a beam and girder type, terra cotta floor. The girders are 20 in. I-sections at 140 lbs., and the beams are 20 in. I-sections at 59 lbs. This floor is designed for a live load of 150 lbs. per square foot. The terra cotta was erected by the Dominion Fireproofing Company. The flooring on this floor is hard wood in the east wing and cement with a liquid hardener finish in the west wing.

The partitions are constructed of terra cotta and were erected by the Dominion Fireproofing Co.

The floors of the halls are covered with Terrazzo, and the post office floor is of hard wood.

The sash in the central section is steel casement sash manufactured by the Trussed Concrete Steel Co. The remainder of the sash is of wood.

The trusses over the ticket lobby have a span of 89 ft. 10 in. The elevation of the lower chord is 110 and the elevation of the top of the roof is 131.10. The main floor is placed at Elevation 22. From this it will be readily seen that the ticket lobby is an exceptionally airy and lofty room, the height of the ceiling giving quite an impressive effect. The ceiling of the ticket lobby and that of the ramp chamber is formed of Gustavino tile construction. This material and method of construction was used in the State Capital building at St. Paul, Minn., over fourteen years ago. The work is just as sound to-day as when it was erected, in spite of the fact that it has received no attention or repair since that time. The material is built up of small laminated squares, somewhat like tile, and is cemented in place. It sets very rapidly and will sustain an exceedingly heavy load. It is light in color and quite pleasing in effect.

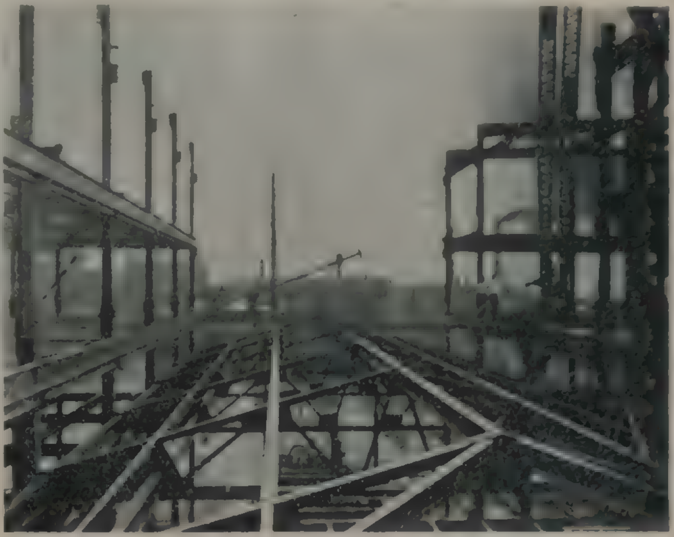


Showing concrete and terra cotta floors in place.

Roof.

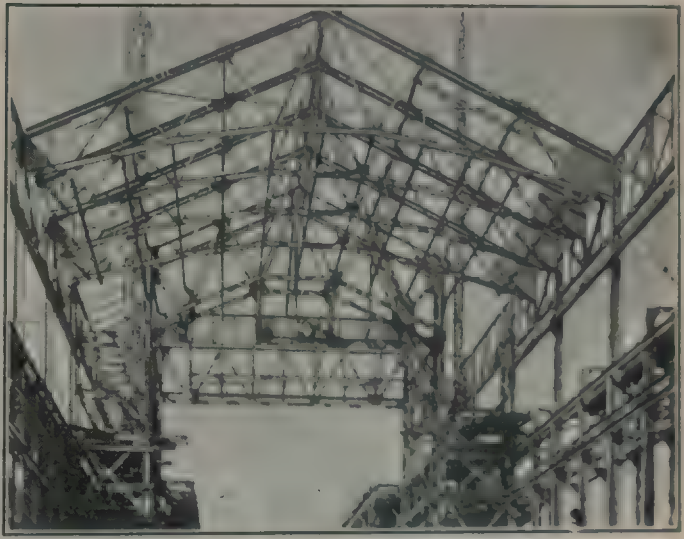
The roof is carried on structural steel trusses, fireproofed with gunite, and is constructed of terra cotta and covered by a standard Barrett Specification roof. The Carmichael Waterproofing Co., Ltd., were awarded the roofing and waterproofing contract, and Mr. Carmichael states that everything was plain sailing, with no trouble of any kind arising throughout the job.

Roof light is secured by means of numerous skylights. These are constructed of steel and copper and are glazed with heavy wired glass. All of the skylights are provided with the usual industrial type of ventilators. Ten dormer windows have been constructed in the roof of the centre section of the building.



West wing showing central roof trusses.

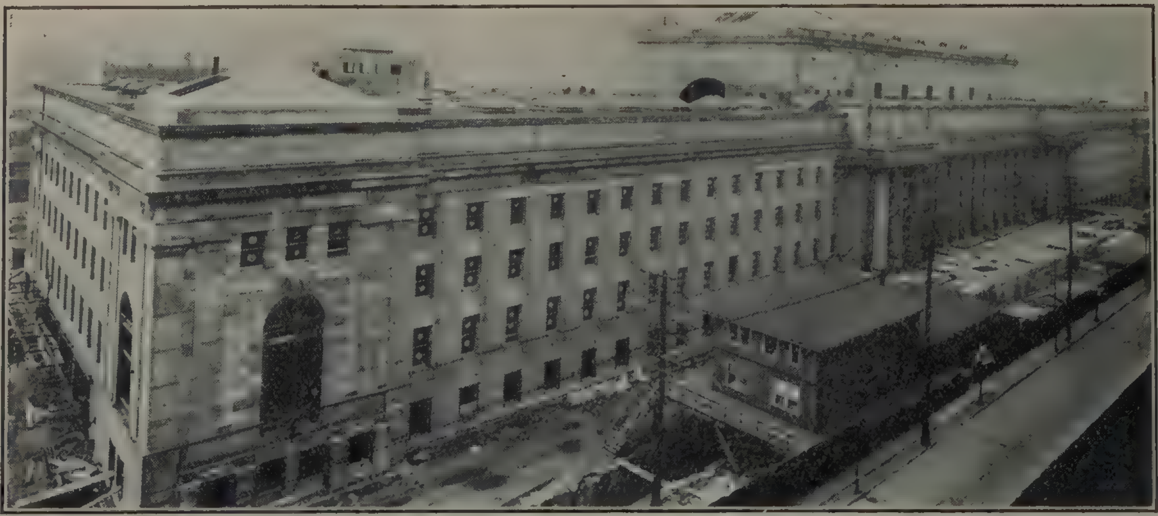
It is interesting to note that the exterior stone columns located at the main entrance of the station are formed of the largest stones ever turned in Canada. The columns are 5 ft. in diameter and are 32 ft. high, exclusive of capital and base. Each one is constructed of three superimposed sections, (See initial illustration), each of which is formed of a stone weighing about 30 tons in the rough, and between 18 and 19 tons finished. A special plant was constructed at Sarnia, Ont., to handle this work.



Roof truss over ticket lobby.

Elevators

In the plans provision is made for twenty elevators of different capacities, freight and passenger. The elevator shafts and pits are completed, but the eleva-



Toronto Union Station—Photo of exterior from north east corner, taken July, 1918.

tors have not as yet been installed. An escalator type of elevator is provided to handle baggage from the basement to the ground floor. The stairways throughout are constructed of ornamental iron work and are well designed with an easy, low riser and a good broad tread.

All air in the building is washed. Batteries of air washers are located in the basement and absolutely pure air is assured. All foul air is drawn off each room through galvanized iron air ducts, by means of suction fans located in the basement.

All of the lavatories are supplied with hot water from independent hot water heaters in the basement.

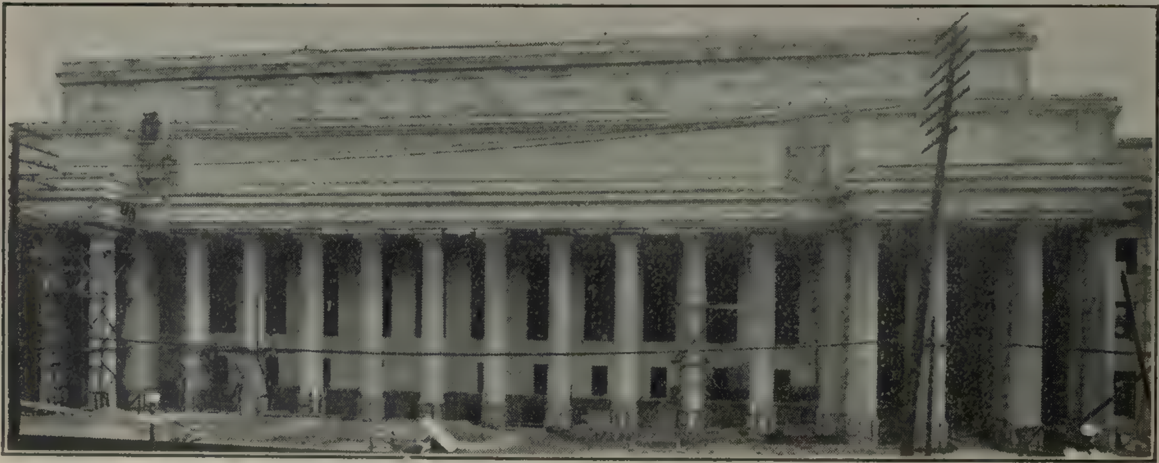
Most of the roughing in for the plumbing has been completed. Some of the plumbing fixtures have been installed, and from these one would judge that only the most modern type of fixtures of the highest class will be accepted. The plumbing contract is in the hands of Wells and Newton, of New York, and the workmanship in this trade, as in all the others, is of the highest class.

The structural steel contract was carried out by the Canadian Bridge Company, and amounted to a total of about 5,900 tons. Each wing required about 1,700 tons of steel. When one realizes that the centre span of the Quebec bridge contains about 5,500 tons of steel, it may, perhaps, be easier to realize just how much 5,900 tons of steel is. The structural steel was painted with a field coat of graphite paint.

The building is equipped with the most modern system of fire alarms obtainable and it will be impossible for a fire to break out in any part of the building without being instantly detected.

No one can go through the building without being impressed with the general excellence of the work. No expense has been spared in the slightest detail to make the new station a model of models. It is an outstanding example of the art of the architect and the craft of the builder.

The plans and specifications were prepared by the Toronto Terminal Architects, of Montreal, an association formed by the firms of Ross & Macdonald and Hugh G. Jones. Mr. John M. Lyle is the Toronto associate. The general contractors are P. Lyall & Sons of Montreal and Toronto. The cut stone was supplied by Geo. Oakley & Son. The engineering features of the work throughout have been in charge of Mr. J. R. Ambrose, chief engineer, Toronto Terminals Co.



A close-up view of the main entrance to Toronto's handsome new station.

Notes on the Desirable Depth of Water Available in Harbors so as to Permit of Development in Ship Dimensions

By A. D. Swan, M. Inst., C.E., M.I. Mech. E., M. E. I. C.*

AMONG the most important questions affecting practically the whole of our ports, are, it seems to me, (1) The depth of water available so as to permit of the most desirable developments in ship dimensions, and (2) The provision of the proper mechanical equipment at the ports in order to facilitate the most rapid loading and discharging of cargoes possible.

(1) The Most Desirable Depth of Water.

Just previous to the commencement of the war, this subject was beginning to receive a good deal of attention, but during the last four years it has of course been a question of building ships in the quickest way possible to suit the present depths of our harbors and docks. Having peace conditions in view, however, I think that the ports which make provision, in the construction of new works, to permit of vessels of greater draught than those regularly in use now, would reap material benefit, and that if the restrictions imposed by the depth of water in harbors and docks were removed, shipbuilders would immediately commence building vessels of much greater depth than those at present being turned out, as from the studies and opinions of some of the most eminent shipbuilders and naval architects of this day, cargoes and passengers could be carried at probably somewhere about half the cost if our harbors were deepened so as to allow of a very considerable increase in the draught of the vessels. This was very ably referred to in "Engineering," about the beginning of 1914, regarding inquiries made by the Dominion's Royal Commission on this subject, and a memorandum by Lord Pirrie, with special reference to the influence of depth of harbors on the dimensions of ships and on the cost of ocean transport. Lord Pirrie expressed a preference for at least 45 ft. as the minimum depth which harbor engineers should recommend and work for, because, although at the present moment 40 ft. might be a satisfactory minimum working depth, the demand from shipping using the ports would grow so steadily as to make 45 ft. necessary before even this depth could be achieved The limitations imposed by depth of channels had involved, his Lordship pointed out, a more rapid increase in the length and breadth of modern ships than in the draught; and yet that increase in draught would yield more important advantages than the augmentations of other dimensions. As to the actual effect of increased draught on the economy of ships, Sir John Biles gave to the Dominion Commission some suggestive data and with your permission I beg to give the following extract:

"Some years ago Sir John Biles tackled the problem and presented to the Institution of Naval Architects a lucid case in favor of increased depth. His paper on that occasion took as a basis a 500 ft. cargo-carrier of 28 ft. draught and 12 knots speed. By increasing the length of the ship to 700 ft. without increasing the draught the actual cost of cargo-carrying would be increased from 8.6s. to 11.2s. per ton of a 5,000 sea-mile voyage, whereas were the draught increased in correct ratio to the length of the ship the cost would be reduced from 8.6s. in the 500-ft. ship to 7s. per ton in the case of the 700-ft. steamer. In other words, advance in size, including depth of hull, if rendered possible by deeper channels and harbors, would convert the loss of 2.6s. in the 700-ft. ship to a gain of 1.6s., as compared with a 500-ft. ship on a 5,000-mile voyage. Sir John Biles made further interesting investigations specially for the Dominion's Royal Commission, the type ship in this case being a passenger and cargo-steamer of 490 ft. and of 14 knots speed. The length of voyage assumed was 3,000 sea miles, and a comparison was made between two conditions, one involving a constant draught of 28 ft. 3 in.—although the length might range up to 1,000 ft.—and the other a draught varying as the length. It was found that in a 700-ft. ship the cost of transport per ton in a ship in which draught was limited (28 ft. 3 in.) was one and a half times as great as that in a ship of the same length, but of proportionate draught. In a 900-ft. ship the cost was twice as great, and in a 1,000 ft. ship it was two and a half times as great. This is accountable from first principles. Sir John pointed out that the weight of hull for the restricted-draught vessel increased much more rapidly than the displacement. The beam could not be increased in the same ratio as the length, or the stability conditions would be interfered with. Before a great length was reached, the dead weight carried no longer increased as the length of the vessels increased, but began to decrease relatively. Further, the excessive proportion of breadth to draught in the large vesel of restricted draught was bad from the point of view of resistance, and therefore those running costs which depended on the power of the machinery were considerably increased. In this line of reasoning there is full justification for future Britannics, especially if, as Lord Pirrie rightly points out, harbors are developed to suit the real economic needs.

"Lord Pirrie pleaded for an increase in depth of harbors to at least 45 feet., but in Professor Bile's 1,000-ft. ship the actual draught works out at 57 ft. 6 in., if the most desirable draught is to be adopted. If the draught cannot be varied as the linear dimensions, the fullest economy cannot be realized. For instance, assuming that a harbor had a working draught of 40 ft., as suggested by Lord Pirrie as immediately necessary, the dimensions corresponding to this draught for a 14-knot ship would be about 700-ft. by 87 ft. by 71 ft. 4 in. depth. Were the dimensions increased without augmentation of draught, the cost of carrying cargo would be rapidly increased, and thus it becomes interesting to investigate the most economical length for ships of a given speed. In the case of a 12-knot purely cargo ship there would according to Sir John Biles, be no appreciable variation between 700 ft. and 800 ft. In a 14-knot vessel the economical length would be 700 ft. if there were no revenue from passengers; but if the vessel were full of passengers, a 1,000-ft. ship would be as economical as a 750-ft. vessel if possible reductions would be made in the weight of hull of the former, due to improvements in construction. At 17 knots the economic length for cargo-carrying without passengers would be 800 ft., and with passengers a 1,000-ft. ship would give about the same economy as an 800-ft. ship. For a 20-knot speed the most economical length would be about 950 ft. for cargo revenue only, so that a 1,000-ft. ship, when carrying passengers, would certainly not, in Sir John's view, be above the economical length. A 1,000-ft. ship requires a draught of 57 ft. 6 in. if the correct proportions be adopted. No doubt some reduction in this draught would result from a reduction in the weight of structure, but Sir John seemed to think that it was not unreasonable to predict that within twenty or thirty years a depth of harbor of 60 ft. could be profitably employed.

"This view is the more justified in consequence of the steady increase in the number of large ships being built and in process of construction. The Dominion's Royal Commission also desired to get information regarding the effect of speed as well as dimensions on the cost of transport. It was not difficult for Sir John Biles to make it quite clear that the cost of transport advances with increase of speed. He was able to establish that the augmentation in the cost of transport under such conditions would be much less in the longer than in short ships were the draught according to linear dimensions and not arbitrarily limited. Assuming an increase in speed from 14 to 17 knots, he showed that the cost per ton-mile was increased, in the case of the 600-ft. ships, 63 per cent., in the 700-ft. ship 32 per cent., and in the 900-ft. ship and 1,000-ft. ship 18 per cent. The same reduced rate of increase was notable in the advance in speed from 17 ton to 20 knots. In the case of the 700-ft. ship the cost per ton-mile of running was more than doubled, for the 800-ft. ship it was 50 per cent., for the 900-ft. ship 30 per cent., and for the 1,000-ft. ship 17 per cent. greater than for 17 knots. It was pointed out further that it was exceedingly difficult to estimate what increased revenue was raised from passengers on account of augmented speed, but it seemed to Sir John not at all improbable that in vessels of 1,000 ft. long and 20 knots speed the extra cost of carrying cargo might be more than balanced by the extra passenger revenue. But his conclusion was that such vessels would not be built with advantage unless the harbors were deepened to draughts corresponding to the depth of ships associated with economic length."

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*Consulting Engineer, Montreal

II.—The Provision of the best Mechanical Equipment in order to Facilitate the most Rapid Loading and Discharging of Cargoes Possible.

This is a subject which I have been giving a little attention for some time past, and in June, 1917, I wrote practically all of the most important Port authorities in Great Britain, as well as abroad, inquiring as to whether those Port authorities were extending their mechanical equipment or otherwise, and at the same time I wrote many of the largest steamship companies asking their opinion on the advantages or disadvantages of Port authorities equipping their harbors and docks with modern machinery, and in almost every instance I was informed that considerable new electric appliances were being provided at the ports in Great Britain and some of the largest shipping companies wrote me that if my views were given effect to, they would increase disaptch by from 10 to 25 per cent. At one port alone, fifty-six new electric cranes of the most modern type had been recently installed, while at another British port new equipment was under order from America. In a paper on this subect of "Port Equipment," read before the Institution of Civil Engineers by Sir John Purser Griffiths, M. Inst. C. E., he stated:

> "Our portal authorities have been slow in realizing the importance of rapid dispatch in loading and clearing ships frequenting their ports. They have frequently checked the extension of port equipment by excessive charges, forgetting that it is not so much making a profit out of such appliances which should be sought as making the port, as a whole, more efficient and economical.
>
> "Shore equipment is essential for the handling of materials on shore, and for hastening the clearing of wharves and sheds. This is as essential as the discharging of the vessel, for if the landed cargoes are not rapidly removed, the discharge of the vessel is delayed for want of quay space upon which to land the cargoes. The congestion of our ports, from which the nation has suffered during the present war, has been largely due to imperfect facilities for handling the goods when landed."

As long ago at the Engineering Conference, in England, in 1907, the late Sir William White made the following striking remark: "As a looker-on, it has been obvious to me for many years that greater rapidity in dealing with cargoes must be the essence of success in commercial operations." Undoubtedly, the controlling condition of the profitable running of cargo-steamers, is the time they must remain in port for the purpose of loading or discharging cargo, and now when freight rates are so high, any machine that can save a few hours in loading or discharging a vessel, would undoubtedly more than pay for itself on one or two trips.

The ports where vessels can get the most rapid dispatch, both in loading and unloading, soon become popular with shipowners and freights to such ports are invariably favorably influenced. Ports are simply commercial enterprises, and, as supply creates demand, the measure of business is rapidly increased where cargoes are handled expeditiously, and where a port, by modern equipment, can accomplish this cheaply or more rapidly than other ports, it is certain to increase its amount of traffic and establish new traffic which might otherwise have passed in other directions.

In considering whether a port can be profitably handled or otherwise, and in studying the various original costs and sources of revenue to be derived therefrom, it must be remembered that the quay or pier walls are generally the most expensive item; consequently, when these walls are completed, the amount of traffic which can be rapidly passed over them, generally decides whether the enterprise is a commercial success or otherwise.

In the latter end of 1913 I had some discussion with the directors of the Hamburg-American Line, in regard to port equipment, and one point I raised was—"What was the reason that their company did not advocate or desire mechanical equipment at any of the Americans ports, such as New York, Boston, etc., while to my personal knowledge, in discussing the same question a few years previous with their representatives in Great Britain, they advocated that ports should be eqiupped with all the most modern machinery posible." In those days, comparatively speaking, labor was cheap in England compared with America, and if their views had been the very reverse and they advocated equipment in America where labor was expensive, I could have understood the matter, but eventually it transpired that their steamers were so well equipped with up-to-date ship equipment that they hoped to be able to capture the trade of Boston and other ports by outstripping the rival lines who might depend more on port equipment supplied by the harbor authorities. It seems to me the reason was very subtle and I believe I am correct in stating that the German Company actually advised the Boston port authorities that it did not desire permanent shore equipment established, as of course, if the port authorities supplied the equipment, then all the steamship lines would have been competing in the open.

In construction work, as a matter of policy, I have invariably worked all the cranes, and such like mechanical equipment, right through the twenty-four hours, working either two or three shifts, thereby saving trouble with the labor by giving shorter hours and getting a greater output from the machines with proportionate increase of profit.

I do not propose entering into detail as to which class of equipment should be provided as different ports have different phases of traffic, and what might be eminently suitable to one port might be entirely unsuitable to another; each must be considered separately. Generally speaking, however, electric cranes seem to be most favorably looked upon as they can be utilized for so many different purposes. As an instance of this, I might mention that at the Avonmouth Docks, Bristol, after much consultation with shipowners and stevedores, we provided on the roof of each of the import sheds, six moveable electric jib-cranes, where, from their commanding positions, they could either—

1. Take cargo from the hold of the vessel, and deposit it direct either into railroad cars or on to the quays.
2. Take cargo on to the ground floor of the shed.
3. Take cargo on to the second floor of the shed.
4. Take cargo on the flat roof of the shed if the goods were non-perishable.
5. Or the same cranes could transfer goods from any part of either of the shed floors to the floor above or below it.

Some three or four years ago, when visiting South America, in connection with harbor matters, I was agreeably surprised to find certain of their large ports equipped with the most modern and up-to-date machinery for the rapid handling of cargo, and, in my opinion, our port authorities would be well advised to lose no time and spend as lavishly as possible in equipping their ports with the best machinery that engineering knowledge and experience can supply.

Mr. Anglin Persists in his Greater Production Scheme

BACKED up by the Montreal Builders' Exchange, Mr. J. P. Anglin, the president, has placed before the Federal Government a comprehensive scheme for utilizing contractors' idle equipment in cultivating extensive lots of land near Canadian cities. The operations were to be under expert agriculturists' direction, and Mr. Anglin obtained the co-operation of many of the foremost authorities on the subject. It was contended that such a scheme would not only provide much needed food, but would return good profits.

The result of the efforts of Mr. Anglin was the formation of the Inland Cultivation Association, the Rockland group of which arranged on Sept. 28th for a demonstration of different types of tractors on land just outside Montreal. The machines ploughed up a considerable tract of land, moving pictures being taken of the operation.

The Association has in view an extension of the work just commenced, bringing into cultivation not only unused sub-divided land, but unused farm land, and ultimately to get to work on prairie lands. The scheme is an ambitious one, and Mr. Anglin has brought it to the present stage in face of very great difficulties.

After the demonstration there was some speechmaking. Mr. H. B. Thomson, the Food Controller, who has backed up the plan from the start, told of how he had been approached last January by Mr. Anglin. Mr. Thomson at once realized the importance of it, largely from the contractors' point of view. Contractors were men who handled their business in a business-like manner. They had to know the cost of everything they did, and keep track of every expenditure. At that time also the question of the lack of agricultural labor was facing them in every part of Canada. Contractors had a certain following, and they were able to handle what was called diluted labor better than any others in the country. The contractor could go on the job with all his own foremen, and could handle farming just as he could any other job. Under each foreman the necessary men could be worked. The idea had appealed to the speaker very strongly, because there was a great deal of idle land adjacent to cities and towns throughout the country. Mr. Anglin had desired to get the project launched last spring, but unfortunately was unable to do so. He had stayed with it, however, and they were seeing before them the results of practically nine months' work. If it were possible to secure 200 towns and cities, each to take care of 2,000 acres of idle land in the vicinity, this would mean about nine million dollars worth of grain, calculating 20 bushels to the acre.

Mr. William Rutherford, treasurer of the association, after referring to the original attempt made by Mr. Anglin to get the project going on a large scale throughout the Western provinces, spoke with admiration of the persistence with which Mr. Anglin had remained with the plan in spite of every discouragement. No one could put $200 to better purposes than by taking a membership in the association, whether they ever saw the money again or not. The utmost would be done to see that the members would have the return of their money, and the whole affair would be run on the most economical basis possible.

Mr. J. P. Anglin

Mr. Anglin stated that it was the intention to give another demonstration when the weather improved, showing seeding in operation. In the United States, the Government had reduced construction work not essential to the war, to the minimum, leaving available a large number of contractors who could be used as supervisors for farm work on a large scale. It was the hope of the organization that the contractors in the United States would take to the idea. Once a success in Canada, it would certainly succeed across the line, he said. Once the first group of 1,000 acres was ready for cultivation, some contractor would be helped to start another group, and eventually it was their hope that the movement would become Dominion-wide, when the real lasting result of the campaign would become evident.

The Administrative Commissioners of Montreal, in their efforts to reduce the municipal staff, have decided to cut down to five the number of building inspectors. The seven inspectors have all been given notice, with an intimation that after an examination, the five most competent will be re-engaged.

Sign Peace at Potsdam

The war will change very suddenly from the appearance of a close-drawn struggle to an absolute German surrender. . . . There are three absolutely essential conditions to a satisfactory peace.

The first is that Germany shall be invaded. Too long has she been led to suppose that she is inviolate. This delusion must be shattered.

The second is the occupation of Berlin and the signing of peace at Potsdam, in the very hall in which the plot was hatched.

The third and most important of all is that Germany must pay to the last penny the expenses her outrageous conduct has cost the allies.

This is both policy and justice. She can prepare no other war while she has such a debt, and she will need no army or navy. In 1915 she planned to exact four thousand millions from France alone.

Revolution could only bring the Social Democrats to the top. These people have, with a small minority, in the main sustained the German attack upon her neighbors. We owe them no consideration. Whoever rules Germany inherits the fruits of her criminal conspiracy against the world.

—Sir Conan Doyle.

Another Private Power Project

ENCOURAGED by the recent success of the St. Lawrence Power Company, the New York & Ontario Power Company has applied to the International Joint Commission for approval of its plans to construct a dam across the Little River on the south branch of the St. Lawrence, at Ogden Island. Canadian interests raise the objection that the dam would seriously affect navigation, and it is the intention of the government and the Dominion Marine Association to oppose the company's application.

The St. Lawrence River has enormous potentialities that should be developed in the most efficient and economical manner for future generations. The Canadian and American governments should keep the control of the river in their own hands. The war necessity plea of the St. Lawrence Power Company cannot be urged in the case of the New York and Ontario Power Company. We in Canada are looking forward to the time when the St. Lawrence Canal system will be deepened to permit the navigation of ocean going ships of large type from the Atlantic to the Great Lakes, and we should fight to the utmost the granting of any concession that will affect this undertaking.

The plans of the New York & Ontario Power Company will mean the withdrawing of 30,000 cubic feet of water per second from the main channel which would mean a reduction in level of 1.6 feet. The company claims, however, that the proposed new embankment would not only provide for this, but would add three to five inches. Capt. W. S. Daily, of Ogdensburg, stated that from his experience of forty years in navigating the north channel, he felt convinced that the construction of the proposed embankment between Ogden and Canada Islands would materially improve the navigation of the channel by increasing the flow of water and straightening out the curves.

Capt. Geo. Bottom, of Kingston, Master Mariner of the Canadian Steamship Company, claims that if the velocity of the current in the north channel were increased one-half by the construction of the proposed embankment, it would be impossible for the slower boats in the service to go up this channel. The side draught would also constitute a menace to barges being towed by tugs.

The total cost of the project, based on 1917 prices, is placed at $2,639,000.

Canada's Grounds of Opposition

The Dominion Government is opposing the company's application on the grounds that:

(1) It will interefere with the full and economic development of the St. Lawrence system as regards the navigation thereof and the power potentialities therein, which are common to both bordering countries and of equal advantage to each country.

(2) It will interfere with the complete regulation, by a dam at Canada Island, of the level and outflow of Lake Ontario.

(3) The future development of the river will necessitate the acquisition of any rights the applicant may have in the river, and the Government of Canada considers it inadvisable to create more.

(4) The St. Lawrence River has enormous potentialities that should be developed in the most efficient and economical manner for future generations. Such a piecemeal policy as proposed is not in conformity with this doctrine.

The Dominion Government claims also that original grantees' rights from the applicants' claim title have lapsed, and that the applicants, as successors, are now asking something entirely different from the privileges granted by the original acts of the Legislature of New York.

Preserve the fruits of prosperity through a policy of thrift. In the past Canada has been too much a nation of spenders. We should now become a nation of savers. If after this flow of prosperity we experience acute depression, it will largely be our own fault. If we save we can weather any storm. What protection shall we have if we fail to save now? What excuse shall we have to offer? The door of opportunity is now thrown wide open to Canadians. Wealth has been showered upon us. Shall we let it all go? If we are thrifty we shall lay aside every surplus dollar. Let us save—for Victory—and for the rainy day that will almost surely follow.

Roadway Improvements in Ontario

Extracts from Annual Report of the Department of Public Highways for the Year 1917

By W. A MacLean, Deputy Minister

ROAD improvement was materially affected by war conditions during the year 1917, more especially by the scarcity of labor, high wages, and lack of railway service for the transportation of materials. Financial conditions have not been entirely unfavorable, particularly on the part of the rural municipalities; but road work has been largely restricted to that which could be carried on with expenditure available from revenue, and bond flotations for this purpose have been very limited in number and amounts. Labor has not, in some localities, been obtainable for the proper maintenance of roads already constructed.

An Old Gravel Road in Middlesex County, After Scarifying, Reshaping and Rolling

Unnecessary labor of all kinds, and unnecessary expenditure should undoubtedly be avoided in time of war, not merely on the part of national and municipal governments, but also by the individual citizen. Acting on this general principle, the Department of Public Highways has not encouraged road construction or expenditure except where dictated by needs of efficiency and economy. It is recognized, however, that the waste of time in transporting goods or in driving over bad roads is very great; that much inefficiency is created by bad roads; and that because of bad roads farm produce is frequently lost or much depreciated by inability to place it on the market. Road construction, rightly applied, is a useful war measure. Reasons of efficiency in transportation render it expedient that certain roads should be built even in wartime; but more important, that others already improved, should be properly maintained.

Road mainteance means very largely that a limited amount of time and effort are expended on the repair and improvement of roads in order that a comparatively great amount of time and energy may be saved in travel and transportation over them; in order that still other traffic which would have to take less economical routes will follow the improved road; and in order that still other traffic which would not exist, may be created and developed. Good roads, desirable as a matter of efficiency in time of peace, are much more necessary in time of war, when economy of men, money and labor is urgent. While the extensive construction of new roads may not be a saving in manpower within the period of the war, the better maintenance of existing roads is undoubtedly a profitable war measure. The strategy of war is largely a problem in roads; and that principle, rightly understood, extends in some degree to the remote points of production throughout the Empire.

The efforts of the Department of Public Highways have been energetically devoted to organization for road development after the war, in order that this important public work may be utilized as far as possible in the adjustment of after-the-war problems. To this end surveys are being made for Provincial work, municipal organization has been encouraged, and it is anticipated that rapid progress will be made at the close of the war in meeting the needs and opportunities of better roads.

County Roads as a War Measure.

A class of roads which are of special value for efficient transportation are those radiating from cities, towns, and shipping points; for it is on these that traffic accumulates, and their improvement will bring the greatest service to the greatest number. As shown by traffic charts contained in the Annual Report of this Department for 1915, these constitute about 20 per cent. of the roads of the Province, and will carry about 80 per cent. of the traffic. The substantial improvement of such roads, or a portion of them, and their maintenance no doubt falls within the definition of justifiable war measures.

The County Road System, through which Provincial subsidies are given to road improvement, is an important means of classifying the roads, setting apart the more heavily travelled market roads for first attention, and thereby limiting the tendency to dissipate municipal expenditure in disconnected works, and on roads carrying comparatively little traffic. Through this system, machinery can be readily applied to the work, thereby displacing much of the manual labor and teams otherwise required, and producing better and more economical results.

A new culvert on the Provincial Highway

County road systems not only tend to efficiency and economy under war conditions, but will also play an important part during the period of readjustment following the war, when unemployment may result, unless adequate preparation is made to meet all possible contingencies of industrial and commercial reaction.

The increased carrying capacity and utility of main roads due to the use of motor vehicles for passengers and freight, have greatly increased the direct value to cities and main country roads. The advantages of good roads in relation to national and community development have been generally adopted in the past, but not to the extent which now marks the situation.

The urgency with which cities have desired the improvement of the main roads of the Province has also suggested, in a marked degree, the benefit which such main roads are to urban centres. Recent highway laws of the Province recognize this important principle, and provide organization whereby cities may contribute directly to the construction and maintenance of main roads adjacent to and radiating from them.

The tendency of municipal organization in the past has been to encourage each local municipality in the belief that it should be responsible solely for the roads within its boundaries, as a city, town, village or township; and has failed to recognize sufficiently the community of interest, obligation, and opportunity for betterment involved in county organization. So far has this spirit existed in Ontario that cities of theProvince, upon incorporation, have been automatically separated county organization, thereby becoming relieved from their obligations with respect to the development of the larger community in which they are located.

A log drag in use on a gravelled section of the Provincial Highway

County organization is a means of uniting the common interests of a series of local municipalities under one body, the County Council. Under these circumstances a readjustment has become necessary, for which purpose "Suburban Road Systems" were authorized under the Ontario Highways Act, thereby seeking to expand the usefulness of the Ontario municipal system by linking up cities with county organization in a slight degree.

The Wrong Method.—Cleaning a municipal ditch, and placing the excavated material (sod, muck, etc.) on top of a fairly good road. This practice obstructs travel and destroys the roads.

Provincial Highways.

The first section of the Provincial Highway System as authorized by the Provincial Highway Act, was taken over by this Department on August 21st, 1917, in accordance with an Order-in-Council dated July 25, 1917, and of which statutory notice was duly given to the several municipalities affected, and in the Ontario Gazette of July 28th, 1917.

This portion of the proposed Provincial Highway System consists of what is locally known as the Kingston Road. It extends from the easterly boundary of York County at the River Rouge to the Town of Port Hope, a distance of 45.7 miles. Portions of this road within the incorporated Towns of Whitby, Oshawa, Bowmanville and Newcastle are permitted to remain under the local authorities. The length of the road actually assumed to date by the Province is, therefore, 38.07 miles within the Counties of Ontario and Durham. As that portion of the Kingston Road within York County from Toronto to the River Rouge is now under the York and Toronto Road System, the Kingston Road from Toronto to Port Hope, a distance of 56.1 miles, is thus designated for improvement and systematic maintenance.*

Provincial highways, such as proposed in Ontario, are not intended as a means of constructing an extravagant system of pavements at great expense—but rather as a means of economy, and of more equitable distribution of the cost. The organization is intended for roads carrying heavy international, and heavy interurban traffic, such as local municipalities cannot be expected to provide for. As this heavy traffic is that of motor vehicles it is but just that the Provincial contribution should be made from the motor vehicle fund. As with county roads, a plan of efficient maintenance and gradual development can be applied, the work being paid for from annual revenue. When traffic becomes so great at any point that maintenance of the existing type of road is no longer econmoical, a more permanent surface can be laid—but the foundation work of widening, grading, drainage, culverts, etc., will be already in place—and paid for.

Motor Vehicle Traffic.

Roads are built for traffic. The cost of roads and also the public value of roads, increases in proportion to the traffic over them. The growing value of the public highway is reflected by the increasing number of motor cars owned in the Province. The motor vehicle registration in 1917 consisted of 78,861 passenger cars, and 4,929 commercial vehicles, a total registration of 83,790 motor vehicles. This is an increase of 29,415 over 1916, and is nearly twice the registration of 1915. Since the year 1911, the registration has approximately doubled every second year; thus registration of 1913 was twice that of 1911, and the registration of 1914, nearly double that of 1912. While this rate of progress cannot continue indefinitely, there is still much room for growth. There is now in Ontario one car for each 39 of population; the average in the United States is one for each 20 of population. The greatest number in proportion to population is in the State of Iowa, where there is one car to each 9 of population. The agricultural states, rather than manufacturing, contain the greatest number of cars in proportion to population. This is true among the provinces of Canada, and in Saskatchewan there is a registration of one car to each 12 of population. In Ontario, the registration shows that 23,409 cars are owned by farmers, an increase of 11,835 in 1917.

Heavy Traffic Highways.

The motor truck as a means of transportation has come into recent prominence through its use for war purposes, through its application to freight transfer between adjacent cities and towns and over routes from fifty to one hundred and fifty miles in length. Indications are many that, coupled with roads of adequate strength, the motor truck will become an ever increasing factor in this regard. Giving evidence before the Railway Commission of Canada in regard to freight rates, it was recently stated by railway officials that the influence of motor trucks on local freight adjacent to large cities is very great; that in certain cases steam railways now receive very little local freight within a radius of fifty miles from large cities having systems of good roads adjacent to them, as it is handled by motor truck.

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*Since this report was written, the following sections have been added to the Provincial Highway System: The Ottawa Prescott, Napanee Kingston, Grafton-Belleville and Hamilton-Queenston roads.

Just as railways were compelled to use heavier rails and increased strength of roadbed to carry heavier trains and engines of the Mogul type, so will it become necessary to build stronger highways to serve the traffic of heavy motor trucks, particularly on main lines between cities and radiating from large centres of population. The wear from comparatively light and rapid traffic of passenger vehicles is first apparent on the road surface. Heavy trucks, on the other hand, while requiring durable surfaces, demand proportionately durable foundations. Heavy motor traffic has a shattering effect on weak foundations. The depth and strength of foundation is a primary consideration in providing roads which will give the motor truck freedom to enter the field of freight transfer to the extent to which it is economically possible.

The cost of constructing roads is largely in proportion to the depth of stone required. The necessary depth of stone will depend largely upon the character of the sub-soil over which the road is laid—the safe bearing pressure of the soil, and upon the maximum weight of loaded trucks permitted to use the road. The maximum weight of truck is a controllable factor, and should be fixed by regulation.

With unlimited funds, roads can be built which will sustain unrestricted traffic. But funds available are limited, and it is therefore necessary that reasonable standards be fixed and strictly enforced; and that roads be then designed for these conditions.

A reasonable maximum weight of truck should be determined; one which will serve the greater proportion of commercial needs. It is not good business judgment to spend large sums to build roads to the standard of a few trucks of excessive capacity. Trucks of excessive capacity should be prohibited. And regulation is particularly desirable with respect to roads of minor importance, and at seasons of the year when all roads are weakened by moisture and frost.

Concrete truss on old stone abutments, designed by Frank Barber, for County of York.

Bearing Pressures of Soils.

Dealing with roads of the broken-stone or macadam type, the maximum load which a road should carry depends in the first instance on the strength of the sub-soil. There is much variation in the supporting strength of different soils, and under different conditions of moisture and climate. Thus "clay" may vary from hard-pan to clay loam; ond a dry clay will support a much heavier load than when wet.

Safe bearing pressures of different soils have been determined in a general way for masonry structures. Experimental investigation with special reference to road surfaces would no doubt develop useful data; but in the absence of more direct information, the bearing pressures adopted for the present purpose are those of the general Bridge Specifications of this Department, viz., gravel, 8 tons per square foot; compact sand or firm clay, 4 tons per square foot; clay moderately dry, 2 tons per square foot; wet clay, one ton per square foot; quicksand or wet, yielding soil, ½ ton per square foot.

The Road Foundation.

A concentrated wheel-load is carried downward through a broken stone crust to the sub-soil, at an angle which, it is estimated, diverges outward at about 30 degrees from the vertical. Thus the effect of the "macadam" crust is to distribute the wheel-load over a greater area of sub-soil; this area increasing with the depth of the stone crust. The depth of stone in excess of the layer needed for immediate surface wear is therefore regarded as the road "foundation." It is the layer of stone artificially laid over the natural subsoil to the depth necessary to sustain an unyielding surface.

The maximum weight of vehicles (apart from the well recognized influence on bridges) thus largely determines the depth of foundation necessary on a given road—the depth of foundation varying also according to the nature of the sub-soil, and particularly in northern climates, the season of the year during which heavy vehicles may use the road. The constant passing of many light vehicles will, it is true, influence the foundation, and to meet this condition a certain "mass" is required; but a very few heavy vehicles may shatter an insufficient foundation and thus destroy the entire construction. It is necessary, therefore, that the engineer should know whether the maximum load is to be 6 tons, 10 tons, 15 tons, or 20 tons; particularly the maximum load concentrated on one axle or one wheel; and also the width of tire on which the maximum load is concentrated.

Broken stone road under construction in Welland County.

A newly finished gravel road in Prince Edward County.

Commonly, a motor truck, itself weighing 5 tons, can carry a load of 7 tons, making 12 tons in all. Two-thirds, or 8 tons is on the rear axle; one-half of that load, or 4 tons, is on each rear wheel. The disruptive effect of this load on roads of light construction is very great—particularly in wet seasons.

Steam trucks, with steel tires, in some cases corrugated, are now in occasional use. As an instance, a 5-ton steam wagon in running order with fuel and water weighs about 6 tons, 10 cwt., with about 2 tons, 15 cwt. on the front axle and 3 tons, 15 cwt. on the back axle. Practically all the load would come on the back wheels, so that when loaded with 5 tons the actual weight on the back axle would be 8 tons, 15 cwt., or over 4 tons 7 cwt. on each rear wheel. Motor trucks carrying 15 tons and weighing in all about 30 tons are being manufactured.

Military experience will probably indicate the most desirable type and weight of truck for future industrial purposes. The great majority of trucks now used by the French armies weigh 3½ tons empty, and 7 to 8 tons loaded. This standard, applied to road construction, generally, would effect a great saving in cost as compared with the maximum of 15 or 20 tons, which unrestricted loading will involve. If military preparedness demands provision for heavy artillery loading of 20 tons (and the tendency is still upward) a more moderate standard should be enforced with respect to the great network of purely agricultural and industrial roads which cannot be so built without imposing an unnecessary financial burden.

On the Hawkesbury-L'Orignal Road.—Constructed in 1917 by the County of Prescott and Russell.

The Government schedule has been drawn up with a view to the traffic law of Ontario, which permits a maximum load of 12 tons, or 4½ tons on one wheel; and a maximum pressure of 650 lbs. per in. width of tire. The general assumptions are: That two-thirds of the weight of the vehicle and its load will be carried on the rear axles; that wheel pressure is transmitted downward at an angle of 30 deg. from the vertical; that the various types of subsoil will safely carry the pressure indicated at the head of each column; that the road crust is solely of broken stone or macadam construction.

From this schedule it is evident that 12 tons is the maximum load which can be carried without producing an excessive tire pressure; that there is little difficulty in providing for a 12-ton load on gravel, compact sand, or firm clay; that clay only moderately dry reqiures a crust approximately 10 in. in thickness; that 12 in. will take care of a 6-ton load on wet clay; but that 16 in. would be required for a load of 12 tons (a condition which could probably be taken care of by a Telford base and broken stone surface having a total depth of 12 in.). In the case of quicksand and wet, yielding soil, it is evident that special drainage or other special construction is necessary to meet the needs of any but a light load.

Sharp turn in the Provincial Highway at Welcome, near Port Hope, obstructed by telephone poles and letter boxes. —See next cut.

As clay is a soil which has very largely to be considered, its drainage and climatic conditions are evidently important factors, as indicated by the difference in depth of crust required by a moderately dry clay and one which is wet.

Self-propelled gasoline motor and steam trucks, in addition to their heavy concentrated load affecting the foundation, have the further disadvantage of exerting a strong shearing force transmitted to the road surface by the driving wheels, so that their use demands not only a heavy and expensive foundation, but an especially durable surface as well. Legislation limiting extraordinary traffic of this description is justifiable, in order that a large increase in the cost of roads may not be necessary to serve the requirements of a few vehicles. Such limitation at the present time forestalls the introduction of unnecessarily heavy vehicles, and avoids cases of individual hardship. Width of tire alone will not solve the difficulty, as, owing to the necessary camber of the road surface, excessive width places the load on the edge of the tire. Should investigation justify it, a less weight than that now permitted in Ontario would be most desirable in the interest of road maintenance.

Dangerous conditions removed.—Turn at Welcome, after widening, and removal of poles and letter boxes.—Compare previous cut.

While the limiting loads for Ontario have been fixed as previously stated, it will be desirable to carefully observe the future trend of commercial traffic in order that, if possible, the maximum load may be still further reduced. In 1917, there were registered in Ontario 4,929 motor trucks. Of these, nearly 75 per cent. were classed as one-ton or less; over 97 per cent. were 3½-ton or less, or within the general military truck standard; while less than 3 per cent. were 4-ton and upwards.

A considerable increase in motor truck traffic appears probable after the close of the war. At the present time in Ontario one vehicle in seventeen is a commercial vehicle; while in the eastern manufacuring states, one vehicle in six is a truck. Growth of motor truck traffic to the latter proportion will undoubtedly create the need for stronger foundations, particularly on inter-urban highways; and over certain qualities of sub-soil the use of concrete in place of ordinary broken stone or Telford base, is strongly indicated.

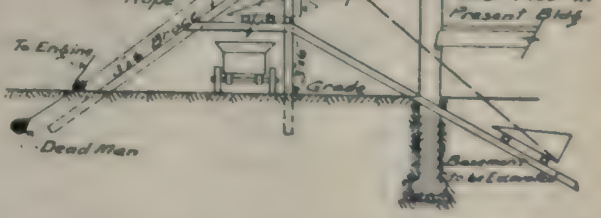
The report also contains detailed references to special work at various points in the province by Mr. George Hogarth, chief engineer of the Department of Highways, and Messrs. Wimund Huber, R. C. Muir and W. H. Losee, assistant engineers.

Look to the Bridges

Highway traffic has totally changed in the last few years' and in place of the one or two ton horse-drawn load, a load of upward of twenty tons may be expected. To-day the five and ten-ton motor truck load and farm tractors up to fifteen tons in weight are quite common. Many of the highways are being improved with a permanent pavement that successfully stands up under very heavy traffic, but the bridges have not always been designed or strengthened to sustain these excessive loads. Every bridge should undergo a careful examination and the allowable safe load prominently placarded for the benefit of motor truck and tractor drivers. If this examination is carried out, no doubt many bridges may be strengthened sufficiently to avert a serious accident and increase the life of the bridge.

A Useful Hoist

Here is a sketch of a hoist to use in excavating under a building for a basement. The box can be let down on a track into the basement; shovel the dirt into the box and pull it out with a horse, and when it gets up over the wagon, it will dump automatically. I find this will cut the labor more than half.—H. C. Wilson, in Concrete.



Digging Pole Holes With Dynamite

A method of setting a blast that will throw practically all of the earth out of a pole hole is described in the September issue of the Du Pont Magazine. The method consists of digging a hole about the depth of one cut of a long-bladed tiling spade and to the exact size of the hole wanted. The bottom is leveled off smooth, and the sides left perfectly straight. This much seems to be essential to good results. Then a hole is bored with a long 1½ in. auger until it is within a foot of the desired depth of the hole. This is to allow for the displacement of the earth downward from the charge. The hole must be made exactly in the center of the spaded hole. If the ground is gravelly or rocky, a punch bar or drill may be required. Then the charge is inserted and tamped down with earth and fired by blasting cap and fuse. A few experiments must be made before the required charge is ascertained, as the amount varies with different soils.

The principle on which this system depends is the slight difference in the resistance of the earth in the sides of the hole over that in the center from the greater thickness. This puts the mass of earth from the bottom of the spade hole down to the blast in the position of a charge of shot and wadding in a gun. When the blast is fired, this mass is started a little easier than the surrounding walls, if the spade hole has been dug deep enough. Then as it springs loose, the force of the blast concentrates on it and throws it out clear and clean. The force of the blast drives the hole at least a foot below the charge, and the hole is completed. This method is not recommended for sandy or light loam soils, as they crumble too badly under the force of the blast.

Road Construction Crew

The crew organization developed in Western Washington for the construction of a concrete roadway, is described in "Concrete Highway". This organization proved quite satisfactory and worked without a hitch. This arrangement of labor, or a modification of it, could perhaps be utilized to advantage on much of our own road work:

Material.

In many cases sand and pebbles have been obtained near the road to be paved, as a rule the sand and gravel banks have sufficient elevation to allow sluicing the material into bunkers. With the many streams in western Washington, water is usually nearby in large quantities.

Under these conditions and with the following crew at the pit and bunkers, 250 cubic yards per day can be turned out.

1 man for pump and engine.

1 man at nozzle sluicing in pit.

1 man helping nozzle man removing large rocks, roots, etc.

1 man at bunkers looking after sand box and keeping chutes clear.

Grading:

Supposing the road to be paved is a well developed highway with proper grades established and that only light grading is to be done prior to paving, the following men will do the rough and fine grading:

1 foreman in charge of grading and ribbon setters.

1 engineer for caterpillar and roller.

1 teamster for Fresno and Wheeler.

4 laborers, pick and shovel work.

When caterpillar is hooked to road grader and scarifier one of the above laborers is used on grade as helper. One of the above laborers also is used at times as teamster's helper.

Ribbons.

The grading foreman has:

1 man setting ribbons.

1 man helper.

Placing Material.

Where the maximum haul is 4 miles, 3 five-ton trucks will handle the output of bunker and put material on ground to run 1 three-sack batch mixer.

Final Subgrade.

2 men are required back of mixer bringing subgrade to exact depth and dragging subgrade template on ribbons.

Mixer Crew for Three Sack Machine.

1 foreman in charge of concrete crew.

6 men are used on wheelbarrow for gravel, 3 wheelbarrows with 2 men to each barrow.

2 men are used on wheelbarrows for sand, 1 man for each wheelbarrow.

2 men are used for cement, 1 man carries cement to bench, 1 man empties sacks into hopper.

2 men for spreading concrete.

2 men for rodding.

1 man for finishing.

1 engineer on mixer if gas engine is used. If steam mixer is used a fireman is necessary.

2 men for covering finished concrete with 2 inches of earth.

2 men watering earth covering on concrete less than 10 days old.

1 man watering subgrade.

1 man for water supply to mixer.

Presuming that the road to be paved is 20 ft. wide with a 1:2:3 mix and a thickness of 6-inch side and 8-inch center, the crew as outlined above should lay 600 to 700 square yards of pavement per day.

The Essex Border Utilities Commission, which recently awarded a contract to Merlo, Merlo & Ray, of Walkerville, for the construction of the east intercepting sewer to serve Ford City, Walkerville, and part of the east side of Windsor, has decided to proceed with the construction of the south interceptor to provide a sanitary sewer for Sandwich, Sanwdich West and Ojibway. The work will be let on the same basis as before, with a fee or profit of $10,000 to be paid the contractor on a sliding scale. Tenders will be received by the commission up to Oct 16. Specifications will be sent out by the commission's engineer, Morris Knowles.

Mr. J. A. Ellis, formerly local member in the provincial house for Ottawa, has been appointed a member of the Ontario Railway and Municipal Board to fill the vacancy created by the resignation of Mr. Kittson. Mr. Ellis has had a varied career, during which he has been Mapor of Ottawa, city treasurer, a member of the Ottawa Hydro-electric Commission; he has also been a prominent member of the Ontario Municipal Association.

When the railway viaduct is built in connection with the Toronto Union Station, the city works department will construct a tunnel for the water mains running under the tracks to the main pumping station at the foot of John street.

A Concrete Stone Book

Concrete Stone Manufacture—by Harvey Whipple; Concrete-Cement Age Publishing Co., publishers; Detroit. This is a second edition of an earlier issue of 1915, revised and considerably enlarged. It brings the manufacture of concrete-stone, with the history of its successes and its failures, up to the present moment. The scope of the work may be judged from the following chapter headings:—The development of concrete building units; what is comprised in concrete stone manufacture; materials and mixtures, standard building units and equipment to make them; layout and operation of factory, with examples; curing; special molds and patterns; surfaces; shop records and cost keeping; building regulations, tests, specifications; selling the products. 310 pages; 5 x 7 in.; stiff linen cover. Price $2.00.

Treating Pin-Holed Woodwork

A good method to adopt in treating pin-holed woodwork is to fill the holes with some alabastine, and fill up the surface with a good coat. Then rub smooth with glasspaper over a cork block, afterwards priming with a coat of white paint. Coat on with best undercoating white, and finally enamel. Alabastine has been found to be fatal to wood worm or any other insect attacks, and it also makes a splendidly hard, smooth surface.

It is announced that the business of The Lauzon Engineering Co., Ltd., Levis, P.Q., mechanical engineers and contractor, marine and general repairs, will in future be carried on by Lauzon Engineering, Limited, which has the same directors and staff.

THE SWEEPERS OF THE SEA

Mr. Punch—"Risky work, Isn't it?"

Trawler Skipper—"That's why there's a hundred thousand of us doing it!"

Published through courtesy of "Punch"

Mainly Constructional

East and West—From Coast to Coast

Three new filters have been ordered for the waterworks system in New Toronto, Ont.

The Union Engine & Machine Works, Montreal, has been incorporated with a capital of $300,000.

Good progress is being made on the construction of the Grand Trunk Pacific station at Smithers, B.C.

The Ascot Tile & Brick Co., Ltd., Ascot Corner, Que., has been incorporated with a capital of $75,000.

The Cats Mining Company, Limited, has been incorporated with a capital of $10,000, head office at Vancouver.

The Columbia Iron & Steel Co., Ltd., has been incorporated with a capital of $25,000, head office at Vancouver, B. C.

Work has been started on the P. G. E. Ry. extension north of Clinton, B.C., and it is expected to average a mile per day.

The Aspen Grove Amalgamated Mines, Limited, has been incorporated with a capital of $1,000,000, head office at Merritt, B.C.

A mining firm, known as the Flathead Syndicate, Limited, has recently been incorporated with head office at Vancouver, capital $10,000.

Contracts for the construction of two steel steamers have been let by the Dominion Government to the Victoria Machinery Depot, Victoria, B.C.

The board of health of Hamilton, Ont., has ordered a sewage system to be installed for the Brightside survey. The cost of the system will be $32,370.

The good roads committee of Elgin County, Ont., has decided to install a screen and an elevator, with bins, at the gravel pit on the Hathaway farm.

The Canadian Car & Foundry Co., Fort William, Ont., have recently secured a contract from the United States Government for the construction of twenty-five steel vessels.

To accommodate a larger number of soldiers this winter at the exhibition grounds at Brockville, Ont., an additional barracks building is to be erected at a cost of $30,000.

Kerr & Goodwin, Brantford, Ont., have been awarded a contract by the U. S. Government for 175,000 semi-steel gas shells. The order involves the expenditure of $1,500,000 and the erection of a new plant by the firm.

The public school board of Sault Ste Marie, Ont., are asking the city council for $100,000 for school improvements. This includes the proposed addition to the Central school, which, it is estimated, will cost about $87,300.

At a public meeting recently held in St. Catharines, Ont., a resolution was unanimously passed that the city council be requested to make application to the Ontario Government for a loan of $80,000 to be used for the construction of homes for workingmen.

The Cotton Company, of Vancouver, has the contract for the construction of the P.G.E. Ry. extension north of the Clinton section—a distance of 52 miles, ending at Williams Lake. Some $300,000 to $350,000 are involved in the contract. The company is required to put up a bond of $100,000.

The contracts for the London military hospital buildings have been let as follows: convalescent and active treatment wards to A. B. Colwan, Toronto; service and dining rooms, to Canadian Construction & Builders, Limited, Brockville; administration building, to Bate, McMahon & Company, Ottawa.

The concrete for the pipe line in connection with the Winnipeg Aqueduct, which is to be run through a tunnel under the Red River, will be placed by means of well casings. Twenty-five well casings will be required in the river and the concrete will be poured down a depth of 60 feet to the tunnel. Thomas Welby, the contractor, has undertaken to do the work for $15,000.

The Ontario government's housing scheme is to be taken advantage of in the erection of dwellings in Hamilton. The McKittrick Syndicate, which owns property in West Hamilton, has made an agreement with the Works Committee to build one hundred houses on the site as soon as the city lays a sewer to serve it, and offer them for sale under the provisions of the Housing Act.

City Engineer Gray and Controllers Robson and Jutten, of Hamilton, Ont., recently visited Toronto to inspect some modern bridges and obtain information in regard to them so as to assist in the selection of the most suitable type of bridge to connect their city with the Toronto-Hamilton highway at the Alley Inn. It is estimated that the bridge will cost between $800,000 and $1,000,000.

The Civil Service Commission under their new and extended jurisdiction, are having the Canadian civil serivce reclassified in such a manner that it will be entirely under their control. The firm of Arthur Young & Co., of Chicago, who are mentioned in press despatches as efficiency engineers, are at work on a scheme which, it is hoped, will render the service more satisfactory alike to the public and the civil servants.

The total value of the building permits issued during the month of August in the city of Regina, Sask., is $160,400, as compared with $164,670, in August, 1917. Last month's figures include $85,000 for the Allen theatre on the corner of Broad and Eleventh and $25,000 for the W. B. Sherman theatre on Eleventh Ave. The total for the first eight months of the year is $814,,990, which is $484,320 ahead of last year when the total for the same period was $330,670.

The remodelling of the former factory of the National Cash Register Company for military hospital purposes, in Toronto, is expected to be finished before the end of the year. The work includes the addition of two storeys to the existing building, and there will also be erected adjoining it an officers' hospital, a nurses' home and large quartermaster's stores. When completed this establishment will be the central military orthopedic hospital for all Canada, and there will be accommodation for over 1,000 patients.

That the Ontario Government cannot see its way to take over important county roads, those that carry inter-county or even to a limited extent inter-provincial traffic, was the bearing of Premier Hearst's reply to the request of a deputation from the Eastern Ontario Good Roads Association, that the government should designate as provincial highways the Pointe Fortune-Ottawa, the Ottawa-Morrisburg, the Ottawa-Pembroke and the Ottawa-Kingston roads. "To adopt your policy," said Sir William, "would mean a complete change in the legislation as it now exists. It would mean doing away entirely with the provincial county roads system and taking over as provincial highways roads which it was anticipated would be built under that system. As far as provincial roads are concerned it was the intent and thought of the Legislature to take over as provincial highways roads carrying what was clearly interprovincial or international traffic, a through road from the east to the west of the province, with one or two important links carrying that class of traffic."

Personals

T. J. Brown has been reappointed chief superintendent of the Nova Scotia Steel and Coal Co., at Sydney Mines N.S.

Mr. Albert E. Ghysens has been appointed engineer for the City of Verdun, P.Q., in succession to Mr. A. S. Clarson, resigned.

Mr. W. McNab, valuation engineer of the Grand Trunk Railway, has been appointed chairman of the valuation committee which is formed of a board of Grand Trunk officials, in accordance with the act of the United States Congress, directing the Interstate Commerce Commission to secure the valuation of all the property owned or used by the common carriers. The G. T., as owners of lines in the United States, comes under this Act. Mr. Arthur Crumpton succeeds Mr. McNab as valuation engineer.

Mr. D. B. Hanna, who was third vice-president and general manager of the C. N. Ry. before it was taken over by the government, has been appointed president of the new directorate as reorganized under government control. The other directors are: Robt. Hobson, of Hamilton, who, in addition to being a prominent business man chiefly interested in the iron and steel industry, has had seventeen years' experience in practical railway work; Frank P. Jones, manager of the Canada Cement Co., who has been serving as vice-chairman of the War Trade Board of Canada; E. R. Wood, of Toronto, president of the Dominion Securities Corporation and the Central Canada Loan and Savings Corporation, and a former director of the C.N.R.; A. T. Riley, of Winnipeg; C. M. Hamilton, of Weyburn.

Trade Publications

Tarvia—An attractive booklet by the Barrett Company, describing the use of Tarvia for preserving roads and preventing dust on driveways of private estates. The booklet is splendidly illustrated with examples of Tarvia roadways around some of the handsomest private homes on the continent.

Homes for Workers—published by the National Builder, 537 South Dearborn St., Chicago. This is one of the most timely publications of the year, describing as it does a number of typical industrial housing developments in many parts of the United States, with plans and illustrations. These should be of great service to the general builder as well as to the industrial house specialist. The designs have been worked out with extraordinary care and appear to represent the best practice for houses of moderate cost. Price 50c.

The Jenckes Machine Company, of Sherbrooke, Que., have just issued a revised bulletin on their ore and rock crusher. This machine is of the Farrel-Bacon jaw type, having semi-steel frame, semi-steel swing jaw, steel pitman and toggle bearings, and is made in sizes from 10 x 7 to 42 x 36. The bulletin includes useful tables on percentages of product through varying perforations, and size of crushed stone. The bulletin is distributed by the Canadian Ingersoll-Rand Company, who are sales agents for the Jenckes Machine Company.

In the new bulletin K-303 issued by the Canadian Ingersoll-Rand Company, Limited, the class EL-2 two-stage straight line air compressor is described. The bulletin indicates the advantages of the tandem arrangement for certain classes of work where economy of space is to be combined with the advantages of two-stage compression, and goes on to give details of construction, including the leaf valves and other features. The bulletin concludes with a note on the short-belt drive with which this type of compressor can be furnished, and which has distinct advantages where space is at a premium.

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Canada Heads the List—In Fire Losses

It is a deep disgrace to Canada that we lead the world in the total of fire loss per capita. One naturally looks for fires in congested areas, if anywhere, but Canada has not that excuse. We have ample space for the necessary isolation of buildings, and ample means at our disposal to combat the enemy, but apparently we are just too careless. Only think what a tidy little sum it would add to our fifth war loan subscription if every man, woman and child had that extra $2.00 which has gone up in smoke since our last bond issue, to add to the total—altogether some $15,000,000.

We print elsewhere in this issue the text of the annual report of Mr. Alcide Chausse, of Montreal, on the present fire situation in Canada and the United States, presented before the American Society for Municipal Improvements. Mr. Chausse is chairman of the Fire Prevention section of the society, and has made a special study of the subject. His review is therefore of special interest, outlining, as it does, the general situation regarding the means being adopted here and there to combat this enemy of conservation.

And the mere money value of the property destroyed is only a fraction of the real loss. Every fire means loss of time to the employees. It also means disorganization of business, because the parti that suffers fire loss is unable to fulfil its c with the attendent inconveniences and losses. gether, a fire record such as Canada's is a con that is a disgrace alike because it can, in a great sure at least, be prevented, and further because it c stitutes a handicap to Canadian industry that we ca not afford.

How Shall the Labor Problem be Dealt With?

One of the most important economic results of the war is the change it has brought about in the labor situation. The existing conditions would have been considered impossible before the outbreak of hostilities, and whether peace will cause a tremendous reaction or will change them but little, is a question which everyone who is interested in industrial progress has been thinking upon.

Labor, in general, cannot be said to have been unpatriotic, but it has, in many instances, been undemocratic in its attitude. It is altogether contrary to democratic principles that any class of people should be able to cry "Hands up!" to the government, and, being a minority, to make absolute demands from the majority. Such, however, is the position taken by the trade unions. Undeniably, labor has suffered grave injustice in the past; it has been ground down, hunger driven, herded in tenements unfit for habitation, and it is possible that these conditions would not yet be rectified had it not been for the formation of the unions. Now, however, with the formidable weapon of organization in its hands, labor is displaying an arrogant, even a despotic, tendency, and there is a possibility that we may find ourselves under the thumb of a new aristocracy, no more acceptable than the old one of birth or wealth. There has always been a tug-of-war between capital and labor; capital has often had the advantage, but at present the balance of power is undoubtedly with labor. Both sides of course overlook the great middle classes, and the "Salariat," as they have been aptly termed, who pay the cash, often seem in danger of being left high and dry no matter how the struggle goes.

In their desire to make things easy for their members the unions have taken an altogether one-sided view of the matter; they apparently do not realize that the abnormal cost of living is mainly due to the exorbitant wages which employers have to pay, and that by demanding more money they have actually decreased its value. There are, of course, profiteers among the producers, manufacturers and middle men, but the profits of industrial concerns are now to such an extent under government regulation, and the newspapers are so prying and aggressive in their attitude that there are but few concerns that "get away with it."

At the same time, however, labor is probably better off financially. Workers are in a position to save more than they would under the old scale of wages and the lower cost of living, but the trouble is that the majority of them do not save. The higher wages have resulted in more and merrier places of amusement, rather than in better homes and bigger bank accounts. It must be admitted that the thrifty, industrious and honest worker has never been, and will never be, too highly paid for his services, but under present day conditions, the man who displays these qualities seldom remains long in the ranks of labor. The average laborer spends all his earnings and is no

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f after a period of prosperity than after a of depression, when his wages are scarcely sufficient to buy the barest necessities.

eryone is anxious that the living conditions of kers should continue to improve, but higher wages ll not bring about the desired effect. Education, ental and moral, is required in the first place, and it is the duty of employers to assist in supplying it, and to see that their employees work and live under conditions conducive to health of mind and body. Labor must be taught, must be assisted and must be reasoned with, where reasoning is possible; else in a spirit of blind selfishness and jealousy, it may make such demands as will upset the whole economic strutcure and react to prevent the industrial development of the country.

Government Has Made Formal Protest

It is announced from Ottawa that the Canadian Government has made a formal protest to Washington against the action of the International Waterways Commission in granting permission to the St. Lawrence Power Company to dam the south channel of the St. Lawrence River at Long Sault, and an Order-in-Council has passed outlining the position of the Canadian Government. Canada takes the stand that under the Ashburton treaty, and the later treaty of 1909, it is definitely stated that navigation in the boundary waters is not to be interfered with. The Government is of the opinion that in view of these treaties the International Commission exceeds its rights in assuming the responsibility of giving authority to proceed with the weir.

Why Not Use Bulk Cement?

For years cement in sacks has been used on practically all work though, no doubt, contractors have often thought of the labor required in unloading, untying, emptying, shaking, counting, bundling and shipping sacks. Why do we waste all this labor when we might be using bulk cement? Cotton, paper and burlap are scarce and high in price and should be conserved to the utmost whereever possible. Any method of doing work that will conserve material and reduce labor to a minimum should be adopted. A study of the problem seems to show that no costly additional equipment would be needed. It should require no more than that necessary for the handling of sand and stone. The bulk cement could be dumped into boxes placed near the mixer or into a hoppered chute. Difficulty has always been experienced in keeping men at work handing cement in sacks owing to the dust. This trouble would be eliminated by using bulk cement. Many economical methods of handing cement in the bulk will no doubt be developed, but even now the contractor should be interested in the saving due to the eliminated sack losses and freight charges on returned sacks.

Mining School in Haileybury, Ont.

A new mining school is being established at Haileybury, Ont. The building, which is of brick construction, was completed some time ago, and the installation of the necessary machinery will shortly be finished. The ground floor is almost wholly taken up with a complete mill of the most modern design. In addition to serving the educational purposes, this mill is expected to be useful in determining the process best suited to the treatment of the various ores met with throughout the mining district. The equipment consists of a small jaw crusher, three light stamps, amalgamating plate, classifiers, 3 x 4 tube mill, concentrating tables, the usual agitators and thickeners. Oil flotation equipment has also been installed which will make it possible to test ores for determining either their free milling qualities, their adaptability to cyanidation, or treatment by flotation. The estimated value of the whole outfit, inclusive of the building, is $30,000. The teaching staff consists of six teachers, including the principal, Mr. W. A. Wilson, all of whom have had extensive experience in the mining field.

The first reinforced concrete ship to be built in China was launched at Shanghai on May 24. This vessel was built for experimental purposes with a 65-foot length, 15-foot beam and a thickness of sides of 2½ inches. She will be propelled by a twin set of "Speedy" motors manufactured in China, and is expected to develop a speed of between 7 and 8 knots. Three standardized vessels of 5,000 tons capacity each will also be built at Shanghai.

He Had "Done Enough"

A Glencoe man was asked recently to contribute to one of the war funds, and replied that he "felt he had done enough." A well-known writer in the Chicago Tribune has this to say about the gentleman:

> **In other words, so far as he is concerned, the war is over and done with. Men whose time is more valuable than the money they give or raise are devoting their entire days to the country's service; but the Glencoe man feels that he has done enough. Women discharge their servants, do their own housework, and labor in Red Cross and other war shops; but the Glencoe man feels that he has done enough. Soldiers, discharged from hospitals in France, feel that they still have something to give, and return to the trenches, but the Glencoe man feels that he has done enough. Mothers, with aching hearts, are sending their sons away to an unknown fate; but the Glencoe man feels that he has done enough. It must be pleasant to be so circumstanced mentally. Few of us are able to forget that the war is still going on.**
>
> **But passing the hat isn't the best thing we do. We are not diplomatic. We have a healthy and perfectly good-natured contempt for a man who can give and won't give, and we haven't any objection to his knowing it. We don't owe him anything—not even, in these days, politeness.**

New Structural Shop Required for Munitions Work

STEEL is the all-important material to-day. Munition requirements have strained to the limit the capacity of every firm engaged in the steel industry in Canada. Where work will be facilitated and the output increased, cost is an almost unconsidered factor. Many plants have been extended more than once to cope with conditions, until they have assumed proportions undreamed of in the pre-war days.

One of the large extensions at present being undertaken is that of Reid and Brown Structural Steel and Iron Works, Limited, on the Esplanade, Toronto. The location of this firm is one of the most favorable in the city. The property extends to the Bay and the company have their own deep water dock. Crane runways extend to the dock giving them the advantage of direct shipment by water. Railway sidings in the plant also permit of direct shipment by rail over any of the railway systems entering Toronto.

The output of the plant consists of all classes of structural steel and fabricated steel, gray iron castings, large and small, also semi-steel castings. Ninety-five per cent. of the output of the plant is for munitions work. The firm have under contemplation ship fabrication and, as pointed out before, the situation of the plant for this work could hardly be improved on. Extension work at present under way will give them a capacity for a normal output of 4,000 tons per annum.

The latest addition is a steel frame building 150 ft. long x 46 ft. wide, and the height from grade to top of roof is 35 ft. A lean-to extension is built on one side, 21 ft. wide and 21 ft. to top of roof. A crane runway extends the full length of the building and 155 ft. at the south end of the building to the deep water dock, a total length of 305 ft. The wall columns are broad flanged Bethlehem sections and the roof is carried on steel trusses as shown in the cross sections. The column footings are of reinforced concrete and are placed 5 ft. below grade. Concrete piers are carried from the footings up to grade and the column base plates are securely anchored into them.

The crane beam is formed of a 15 inch I-section and is designed for a 10-ton electric travelling crane. It is carried on independent columns tied with steel plate brackets to the wall columns. Skylights, as shown in the drawing, are provided. These are constructed of galvanized iron and are glazed with heavy wired glass. Ventilators are located as shown.

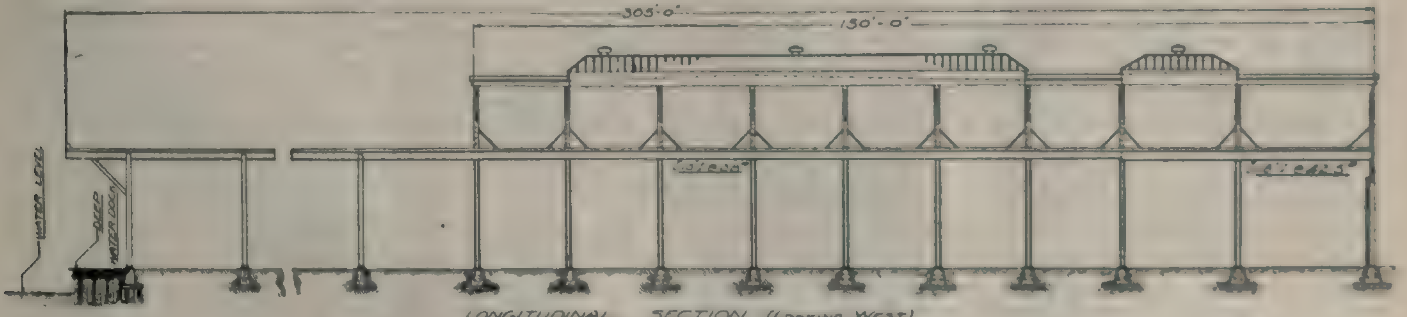
The building will be well lighted. The windows are as large as it is possible to make them and wood sash is used throughout. The roof is formed of 2 in. x 10 in. at 16 in. centres and stiffened with bridging. The roof deck is laid over this and is covered with standard Barrett Specification roofing. The sides of the building are to be sheeted with galvanized iron.

The present building is indicated by dotted lines in the drawing and that portion inside the new extension will be removed when the work is completed.

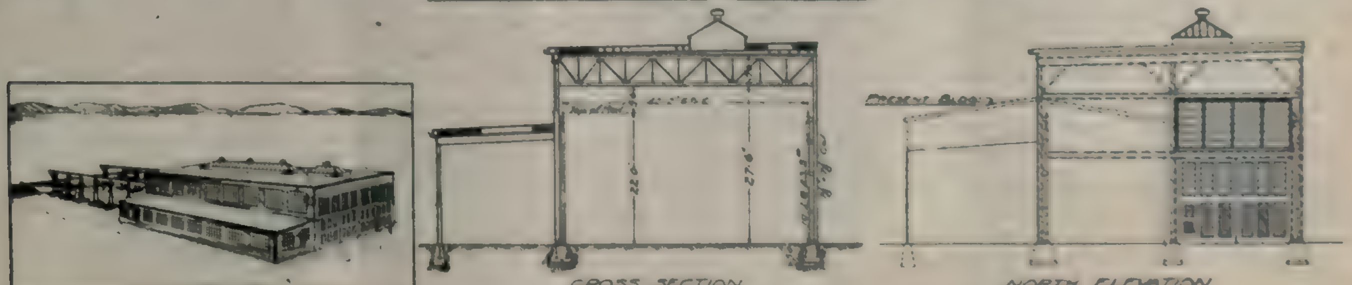
The company purpose installing a system of industrial tracks; this, with the rearrangement of their machines and other equipment, will enable them to handle work at a minimum cost. A 5-ton travelling crane is to be erected in the lean-to section of the building which will be used for the fabrication of the smaller work.

When the work is completed it will be a most modern and up to the minute shop in every respect.

Mr. George D. McDougall, chief engineer of the Dominion Iron and Steel Company, has resigned to become General Superintendent of the Nova Scotia Steel and Coal Company.



LONGITUDINAL SECTION (LOOKING WEST)



PERSPECTIVE VIEW CROSS SECTION NORTH ELEVATION

Sections and perspective view of Reid & Brown's new works.

Safe Construction of Scaffolds and Falsework

By T. F. Foltz*

POOR and inadequate scaffold construction may be traced largely to the desire on the part of builders to use old and poor lumber. Subcontractors generally fail to include sufficient money in their bid to cover this contingency, depending on using scaffolds erected by the general contractor. These scaffolds may have been satisfactory for their original purpose, but in some cases may not be adequate for the use of the subcontractor. Even though sufficient money has been included in the bid for the erection of proper scaffolds, there is a great incentive to skimp this portion of the work in order to increase the amount of "velvet." Too much dependence is usually placed on picking up sufficient lumber about the job to construct scaffolds. In this way not only will improper sizes be used, but the material may also be mostly inferior and defective.

The work of building the scaffold is too often delegated to unskilled persons because it is not a permanent structure and appearance is no object. Many accidents can be traced to this cause, and it is surprising that we do not have more of them. The contractor should delegate a thoroughly experienced man to be responsible for this work, and all building, changing, and removal of scaffolds should be done under his jurisdiction.

Pole Scaffolds.

The general construction of the pole scaffold, used mostly by bricklayers, is as follows: Poles or uprights about 4 in. square in cross section are erected about 7 ft. 6 in. apart on a line approximately 4 ft. 6 in. from the wall. Stringers 1¼ in. thick, and from 8 to 12 in. wide, depending on the load they are to carry, are nailed on the poles in a position parallel to the ground. These are spaced vertically about 5 ft. apart and serve as the outer bearings for the putlogs. The inner ends of the latter, having a cross section of about 3 by 4 in and a length of about 6 ft. rest in holes left in the brick wall.

The putlogs support the platform planks, and there should be a sufficient number of them so that there will be at least three under every plank. With 16-ft. planks, about 2 in. thick and 10 in. wide, the putlogs may be spaced the same as the uprights, namely, 7 ft. 6 in. apart. If thinner planks are used the putlogs should be placed closer together. The planks, with the above dimensions, will lie 5 wide in the space between the buildings and the uprights. Their ends will overlap each other 1 ft. and there should be a putlog under this point of overlapping to avoid the formation of a blind trap.

It will not be necessary to nail the putlogs or planks in position unless local conditions require that they be erected on an incline, or heavy vibration or other considerations should necessitate such a precaution. There should be a guard rail, at least 3 in. by 1½ in. in cross section, erected along the uprights parallel with the platform and about 34 in. high. A similar guard rail should also extend across any window openings on the building side of the platform where these openings extend to more than 34 in. above the platform. Below this rail, along the outer edge of the platform, a toe board about 6 in. deep should be provided to prevent material from falling from the scaffold. If material such as bricks is to be placed on the platform in piles higher than the toe board, then the latter should be higher accordingly, or the space between the toe board and the guard rail should be filled in with boards or substantial wire screening.

In order to eliminate the possibility of the pole scaffold collapsing in a direction parallel with the walls, there should be substantial diagonal braces nailed across the uprights. There should also be braces nailed to the building at various points, such as window frames and other points of attachment, in order to prevent the scaffold from falling away from the building. On blind walls where there are no points available for nailing braces of this kind, spring stays may be used. To make a spring stay, two boards are inserted in the hole in the wall left by the removal of a putlog in raising the platform to a higher level, and a brick is then placed between the two boards and pushed to within a few inches of the wall. The outer ends of the boards are then sprung together and nailed fast to the scaffold. The result is that both boards at their inner ends are pressing against the top and bottom of the hole with such force that there is sufficient holding power to prevent the scaffold from falling away from the building.

Independent Pole Scaffolds.

The design of the independent pole scaffold departs somewhat from that of the pole scaffold. Instead of using the building as the inner support for the platforms, an additional set of uprights is erected close to the building. This kind of scaffold is often used by stone masons as it is usually undesirable to leave openings in stone walls for the reception of putlogs. These scaffolds are usually made in larger dimensions than the pole scaffolds, and a greater amount of bracing is necessary on account of their being independent of the building for support. Instead of the usual putlogs resting upon the ledgers as in the pole scaffolds, boards about 1½ in. thick and about 9 in. wide are nailed on the sides of the uprights just above the ledgers and perpendicular to them and the building. These bearers, which correspond to the putlogs, add considerable bracing to the structure on account of being nailed fast.

This scaffold is usually made twice as wide as the pole scaffold, and larger members are used throughout on acocunt of the greater strain upon the various parts. The method of laying flooring is substantially the same as that for the pole scaffold, and the same consideration should be given with reference to the guard rails and toe boards. Better footing is required in these scaffolds on account of a greater weight resting upon each upright. Where there is any question as to the ability of the soil to hold the pole, there should be a substantial block of wood, about 2 in. thick and a foot square, nailed to the bottom of the upright in such a manner that a larger bearing area will be secured. Stones or bricks should never be used under uprights in any kind of a scaffold as they are very easily knocked from position by trucks or material bumping against the uprights.

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*Mechanical Engineer, Pennsylvania State Department of Labor and Industry. Before National Safety Council.

Suspended Scaffolds.

Pole and independent pole scaffolds are generally used for buildings up to about 6 stories in height. Above this height the construction of these scaffolds becomes a large item of expense, and there is also a greatly increased element of danger connected with high scaffolds due to the great weight coming upon the bottom uprights. On high buildings it is now customary to use suspended scaffolds, which usually consist of substantial platform planks resting upon putlogs, each end of which is suspended by means of a cable hung from an overhead beam projecting from the building. These scaffolds are usually equipped with means for raising and lowering the platforms, which consists of a machine for each cable with a drum and means of winding up the cable.

There are two principal types of these scaffold hoisting machines: on one the winding drums are located on the platform, and on the other these drums are located on the beams overhead. Advantages are claimed for both systems, and no attempt will be made here to justify the use of one over the other. The first type is worked usually by a lever and ratchet operated directly on the cable-drum on the platform; the other is operated by means of worm gears and a sheave wheel driven by a tiller rope which extends within reach of the men on the platform. These scaffolds are usually provided with cables approximately 100 ft. long, and where it is necessary to work beyond this range, the scaffold is relocated to a new position above after the cable is wound up.

Suspended scaffolds should never be used without guard rails and toe boards on account of the great height at which they are operated. It is also advisable to fill in the space between the guard rail and toe board with substantial netting having openings no greater than ½ in.

Outrigger Scaffolds.

At certain places, such as under big cornices and other special construction, platforms are often placed upon beams thrust out from the building. These beams should be of substantial dimensions and excellent quality, and they should be rigidly fastened on the inner ends to floor beams or substantially braced against overhead beams. No dependence should be placed upon these cantilever beams being simply fastened into the wall; they should project inside of the building to some considerable distance and there be securely fastened. Guard rails and toe boards should always be used with this type of scaffold, and the planks should be provided with the same consideration as used for laying the planks in pole scaffolds. These scaffolds are not recommended where it is possible to use one of the other types.

Carpenters' Bracket Scaffolds.

With the carpenters' bracket scaffold, platform planks are placed upon brackets, which consist of horizontal and vertical members, usually about 4 ft. long, and a diagonal member to provide the necessary bracing. These members are bolted together in a substantial manner, and the bracket is placed on the building with its horizontal member perpendicular to the wall. It is held in that position by a bolt anchored at the inner end of the horizontal member, extending through that wall, and bolted on the inside. This bolt, usually about ⅝ in. in diameter, should not be simply bolted through the sheathing, but should project through a substantial block that extends across the inside of the studs.

There should be sufficient brackets in order that there may be three under each plank. Thus with 16-ft. planks, the brackets should be no further apart than 7 ft. 6 in., in order that the planks may overlap each other about 1 ft. over every alternate bracket. This type of scaffold does not adapt itself very readily to the installation of guard rails and toe boards. These rails and toe boards may, however, be installed without much trouble, and where the scaffold is used more than 10 ft. above the ground, they should certainly be erected. It is a very common practice to lay the platform planks upon these brakets in such manner that the points of overlapping do not always come upon a bracket. This forms a blind trap, and under certain conditions may result in a man being precipitated to the ground below, should he place his entire weight upon the unsupported point of overlapping.

Painters' Scaffolds.

The painters' scaffold consists of a ladder-like platform having parallel sides but somewhat wider than an ordinary ladder, each end of which is suspended by a triangular stirrup. This stirrup is usually made of ¾-in. wrought iron or steel, and at the upper or apex corner the metal is in the form of a smooth loop for the reception of the hook of the lower hoisting rope block. The upper block of the hoisting rope is held by a large wrought iron or steel hook, about ⅝-in. diameter in cross section, which is hooked over the cornice of the building in a substantial manner. The stirrups should have appropriate brackets or the installation of guard rails as well as toe boards, and it is noted with a great deal of satisfaction that this type of scaffold is being provided with these rails more generally now then several years ago. The scaffold is raised or lowered by the men on the platform and the free end of the rope is deftly looped under the rounded apex of the stirrup and over the hook in such manner that the platform is held in position without any further securing of the rope.

The loose ends of the rope below the fastening should be protected from injury or tampering by unauthorized persons on the ground and it is a good plan to coil this free portion of the rope upon the platform. Projections in front of the platform, with rollers on their ends, bear against the side of the building and determine the distance that the platform shall have therefrom. Where the distance from the platform to the point of support overhead is great, the scaffold should be lashed to the building in a substantial manner in order that it will not swing away from the building and thus present a considerable hazard to the workmen. When the men leave the scaffold for any length of time, they should either lower it to the ground, or at least lash it securely to the building in such a manner that it will not be blown about by the wind. Buckets and other tools should not be left on the scaffold as they may fall to the ground below with possible injury to persons. No more than 2 men should regularly work on one painters' scaffold, and no more than 3 men should ever be on the scaffold at any one time. Several painters' scaffolds should not be combined by bridging the spaces between them with planks in order to cover a greater amount of the building with a small number of scaffolds.

Needle beam scaffolds are used largely for riveting steel work on buildings and for working under roofs. It consists of a plank platform resting upon two beams which are suspended at each end by means of ropes. Where beams span from 10 to 12 ft., they should have a cross section of at least 4 by 6 in.; for larger spans, larger beams accordingly should be used. Great care should be used in the placing of the platform planks. The beams should be parallel, and in case local conditions require that one beam be lower than the other, the platform planks should be provided with bolts in each end to prevent them sliding over the beams. It is best practice in any event to have the platform planks always fitted with these bolts placed about 6 in. from each end. In some cases guard rails on this type of scaffold may be a hazard instead of a help. Where the work consists of swinging a maul or a sledge, the guard rail may promote an accident instead of preventing it.

Plasterers' and Decorators' Scaffolds.

Plasterers' and decorators' working on large interiors, usually operate from scaffolds designed somewhat similar to independent pole scaffolds. These cover the entire floor in order that access to the ceiling may be had as well as to all the walls. For very large areas, scaffolds are usually constructed around the 4 walls of the room, and suspended or needle beam scaffolds are hung from the ceiling. In erecting the side scaffolds the same precautions should be taken as with the construction of independent pole scaffolds. The parts should be well braced, and the same care should be taken as to the installation of guard rails and toe boards. There is a difference of opinion as to how the platform planks should be laid overhead. Many authorities believe that it is satisfactory to permit a space of 6 in. to a foot between the various planks, assuming that the men will not fall down through such a space. This, however, does not prevent tools or material from falling to the floor below and possibly upon persons, and it is more desirable that the platforms be built solid, particularly at the points where the men do their work. For lower ceiling heights horse scaffolds and ladder scaffolds may be used.

Horse Scaffolds.

Horse scaffolds consist of strongly made trestles over which platform planks are placed. They are used largely by stone masons for both inside and outside work. The work is first carried up about 5 ft. from the base, after which a platform is erected with horses about 4 ft. high, together with the usual platform planks. When the work is again carried beyond reach of the men, another horse-scaffold may be erected upon the first, care being taken to see that the horses are placed directly one above the other. It will not be necessary to leave all the platform planks upon the first scaffold. The outside planks, or those upon which the legs of the horses rest, should remain in position, and the others may be removed for use above. If the work is being done inside, it is possible that the men may reach the ceiling without erecting any more tiers, and the work may then be carried on from the floor above, provided the building is of steel construction and the floor beams have been constructed before the side walls. There are cases where builders erect horse scaffolds in 6 or even 8 tiers high, but we do not consider it advisable to go beyond 3 or 4 tiers. It is not an uncommon sight to see bricks or other material under trestle legs, and in such a case there is needed only a slight jar to upset the whole scaffold. It is advisable that, where these scaffolds are erected in tiers, the trestle legs be nailed to the planks upon which they stand. This will give increased strength to the scaffold and help to prevent its collapse due to vibrations caused in any manner. A scaffold of several tiers should also be braced against the side of the building, or by diagonal braces from the floor.

General Requirements.

The lumber used in scaffolds should be either spruce or long leaf yellow pine; hemlock should not be used as it is too brittle. All parts should be free from defects such as injurious ring shakes and cross grain or unsound knots. Nails should be of the best quality, and they should be driven full length, the bending over of partially driven nails being poor practice. Cables used with suspended scaffolds should be not less than ½ in. in diameter; they should be plow steel, 6 strands, 19 wires, and have a factor of safety of at least 5. They should be galvanized to order. Steel ribbon should not be used for suspended scaffolds as it is more liable to break and is easily kinked. Where rope is used it should be of the best manila grade, and, where it passes over sharp corners, it should be protected from abrasion by padding or other suitable means.

Where scaffold uprights are spliced, they should be butted together and at least two boards, about 4 ft. long, should be nailed on two adjacent sides. The splices on adjacent uprights should not be at the same level, but should be staggered. Where fixed ladders are constructed on scaffolds, they should extend about 45 in. above the platform, in order to facilitate the landing of the workmen. Single pole ladders should not be used. Where the scaffolds are to be used a long time, it is preferable to construct stairways having full treads and substantial railings. Runways to platforms should not have a greater rise than 1 ft. in each 2 ft. of length. Where the rise is greater than 1 ft. in 5 ft. of length the run way should have cleats nailed thereon about 8 in. apart to prevent slipping. The centre portions of the cleats may be omitted in order to provide a wheelbarrow track.

Where necessary, overhead protection should be provided for persons or workmen about scaffolds in order to catch falling objects. Where a sidewalk under a scaffold is kept in service, it should of course be entirely bridged over with substantial material. All doors being used on ground floors of building should have ample protection over their entrances. Suspended scaffolds should also be equipped with either heavy canvas or heavy wire netting covers where used with tall buildings, in order to protect the workmen on the scaffolds.

Consideration should be given to the use of life lines and safety belts for men working on thrust-outs and high elevations. These, however, should be used with caution, as they may in certain cases hamper the workmen and possibly promote accidents. In large auditoriums having high ceilings, and also for structural iron workers operating at great heights, safety nets are often used advantageously to catch workmen should they fall. These nets should be constructed of at least ½-in. manila rope having meshes no larger than 4 in. square and borders of at least ¾-in. rope.

Falsework.

A great deal of the foregoing material applies to the construction of falsework. This class of construction cannot be standardized to the same extent as scaffold work, hence it will be impracticable to give, in detail, specifications for safe construction. Whether the falsework is erected to support a stone or brick arch, or partakes of the elaborate work used in the building of some of our modern masonry and concrete bridges and similar structures, it should in every case be given careful treatment, and be designed according to the stresses to be met. In most cases it will be necessary to make drawings giving as much detail as if the structure were a permanent one.

Only the most experienced men should be entrusted to the construction of this class of work, and propositions of large dimensions should be handled as faithfully as though the structure were going to be a permanent one. In the design and construction of all false work, great consideration should be given to the method of its removal after it has served its purpose. False centers should be so desigend that, by collapsible keys or other means, they may be removed without straining or damaging the permanent structure.

Methods of Clearing Ice Gorges

IN a paper recently delivered by Lieut-Col. H. W. Stickle, United States Army, before the Engineer's Society of Western Pennsylvania, interesting methods of clearing ice gorges last winter in the Monongahela River were described.

The lower end of the gorge began at the Bridgeport tipple ice-breakers, 0.7 miles above Lock No. 5. The ice was packed to the river-bed except in the channel where it varied from 4 to 6 ft. in thickness. Farther up stream it was found to be of greater thickness and more compact until at the cofferdam, about 2,000 ft. above the Bridgeport tipple, it was packed about 6 ft. below the river surface and piled to a depth of 4 to 12 ft. above the river surface for a distance of 600 ft.

This ridge of ice extended diagonally across the river and was wedged between the cofferdam and the mouth of a small creek on the opposite side of the river a short distance below. This ridge formed the key to the situation since it was of sufficient strength to stop the ice, piling against it from above, and by its position it protected the field of less compact ice below it. To break this key it was attacked from the down-stream side after a channel 1,500 ft long had been blasted through the ice-pack below.

After all shore ice possible had been loosened at the lower end of the gorge by ramming with steamers, blasting of the channel up-stream through the center of the ice-pack was started. Eight holes were first disposed in a semicircle of about 300 ft. in diameter, the curve being convex to the direction of the current. The holes were from 12 to 18 in. in diameter, chopped through the ice or to the river-bed where necessary, with a long chisel bar. From 10 to 12 lb. of 40 per cent dynamite per hole were tied in weighed cement sacks, lowered through the holes and suspended under the lower surface of the ice. All eight shots were exploded simultaneously.

The ice was well shattered in the areas encircled by the holes and for 10 to 20 ft. above each hole. After all loose ice had floated away, a steamer by ramming and then pulling with a snag hook, removed everything up to the solid breast. The same procedure was followed with successive series of holes until a channel 1,500 ft. long had been cut up-stream to the ridge forming the key. The number of holes was decreased from eight at the down-stream end of the channel to five at the up-stream end, the width correspondingly decreasing from 300 ft. to 100 ft. The width was also controlled to some extent by variation in loading of the end holes of each series. A line of five holes was then laid out diagonally, upstream from the opened channel to the left shore opposite the mouth of the creek, and in such a position as to cut across the down-stream corner of the ice ridge. When these holes were fired, the greater part of the ice along the left bank below them was loosened and floated out and a slight movement of the ice ridge was noted. A second diagonal line of holes, paralleling the first line but about 300 ft. farther up-stream, was next fired, breaking the ridge at its juncture with the left shore. The entire ridge began to move, pivoting about its right end at the Brown cofferdam, and was quickly followed by movement of the entire gorge above that point, which at the time extended to Fredericktown, Pa. The river, at this time, was 7 ft. above the crest of Dam No. 5.

Moderating weather, together with softening and sinking of the ice, due to suspended silt, had started the upper end of the gorge to move and undoubtedly contributed to the success of the undertaking. In drilling blast holes it was noted that for the upper 18 in. the ice was very hard, but below that point it was usually softened and honeycombed and filled with silt. After the final movement had started, the entire gorge passed a given point in three hours, but it disappeared so rapidly, by shattering on the dams and sinking, that practically no ice reached Pittsburgh.

An attempt was made to use blasting powder instead of dynamite to shatter the ice, but this proved to be a failure. Five 1-gal. jugs were each loaded with 10 lb. of blasting-powder and one No. 6 electric exploder. After the lead wires had been arranged in slits in the corks and sealed with soap, the jugs were suspended below the ice and the charge exploded. No appreciable shock or lifting effect was observed, probably because the action of the powder was so slow that pressure was relieved by displacement of the water.

There is No Such Thing as Rubbish!

A single example will serve to show the truth of this statement. The refuse from Army kitchens has yielded sufficient tallow to provide soap for the entire needs of the Army, Navy and government departments, and glycerine enough to propel 23,000,000 eighteen pounder shells.

Aids in Handling Lumber

Wherever quantities of rough lumber must be loaded, unloaded, or piled, a pivot stand is of great assistance in the work of handling. Such a stand consists of a central upright erected on two crossed bottom pieces, the ends of which are mortised into four slanting legs which grip the upper part of the central piece. Into the end of the upright is set a stout steel pin having a rather blunt point. The stand is placed alongside the wagon or lumber pile and is used as a pivot where leverage accomplishes much of the work ordinarily done by actual lifting.

The McArthur Concrete Pedestal Pile

IN almost every case, pile construction is necessitated by low-bearing power of the soil. Where it is not practicable to drive the pile to rock, its bearing capacity, due to the small bearing area it presents, is limited to the frictional adhesion between its surface and the earth. In a recent issue we described a piece of construction work at the plant of the Algoma Steel Co., where the McArthur pile, somewhat uncommon in Canada, was used. The following description of this pile may prove valuable to some of our readers:

The McArthur pile is a pedestal concrete pile of a particular form and made by the particular specification of the McArthur Pile & Foundation Co., of New York City. This pile consists of a cylindrical shaft or stem, approximately 16 in. in diameter, with an enlarged base or foot. This enlarged foot giving great bearing area, will naturally give a greater bearing capacity to the pile. The equipment necessary in the construction consists of a cylindrical steel casing and a core or rammer which fits inside the casing. This apparatus is driven into the ground to the required depth. The core is then removed and a charge of concrete is dropped to the bottom of the casing. With the core as a rammer, this concrete is then forced out against the soil at the bottom of the casing and the operation of charging and ramming continued until a bulb or pedestal of the required size is formed. After this the casing is filled with concrete and pulled slowly and evenly out of the ground, leaving a pile of the size and shape mentioned. The weight of the core and hammer rests on the concrete while the casing is being withdrawn. The core is formed of a pipe smaller than the casing, inside which it fits, and has a blunt cast steel head. In the head of the core is an oak driving block for the hammer blows.

Referring to the drawing in Fig. 1 the core is shown in (1) fitted into the casing and both driven into the ground to the desired depth. In (2) the core is pulled out and concrete is dropped to the bottom of the casing. In (3) the casing is pulled up slightly, the weight of the rammer being on the concrete, and (4) shows the rammer driven down and forcing against the soil and beginning to form the pedestal. This operation is continued until the required footing is secured, when the casing is filled with concrete to the top, as shown in (5). The casing is now withdrawn by placing the end of the core on top of the concrete which, with the weight of the steam hammer (a total weight of about 5 tons) presses down the concrete, permitting the casing to be slowly and evenly pulled out of the ground. This leaves the pedestal pile in place as shown at (6). When much ground water or a fluid soil is encountered at the lower end of the pile, a cast iron point may be fitted to the lower end of the casing while the core is being removed, and the first charge of concrete is being placed. Afterwards the successive charges of concrete act as a seal while the pedestal is being formed. This cast iron point remains in the ground and forms part of the pedestal.

In the operations at the Algoma Steel plant, the weight of the core with the cap was 6,700 pounds and the weight of the striking part of the hammer, 300 pounds. The casing was driven until ten blows of the hammer secured a penetration of one inch.

The concrete for these piles consists of one part portland cement, two and one half parts of sand and five parts of broken stone or gravel, measured by volume.

The required length of each pile was determined by driving the pile, or pile forming apparatus, into the ground until the penetration under the following formula, to support the necessary load was obtained.

$$\frac{2\,w\,h}{s+.1} = \text{safe load per pile}$$

The loading test on four piles under a load of 120 tons of pig iron showed a maximum settlement of 5/16 inch.

How a Pile Supports Its Load.

In "A Practical Treatise on Foundations," by Patton quoted in Concrete Engineering, the following equation is given for the total carrying capacity of a pile:

$L = bA \times fS$. in which

L=the safe supporting power of the pile.

b=the safe bearing power per sq. ft. of the soil at the point or base of the pile.

A=The area, in sq. ft., of the base of the pile,

f=the safe frictional resistance per sq. ft. of soil penetrated by the pile, and

S=the number of sq. ft. of surface in contact with the soil.

Patton further states that, as A and S are known from the size and shape of the pile, if we know b and f, we can determine the supporting power of the pile under any conditions. For most cases b, the bearing power of the soil at the foot of the pile, can be quite accurately predetermined, but f, the frictional resistance, is of a somewhat less determinate nature. It ranges in general from 100 lbs. per sq. ft. in the softest soils to 600 lbs. per sq. ft. in compact sand and gravel. From Patton's equation the carrying capacity of different types of piles can be computed and compared.

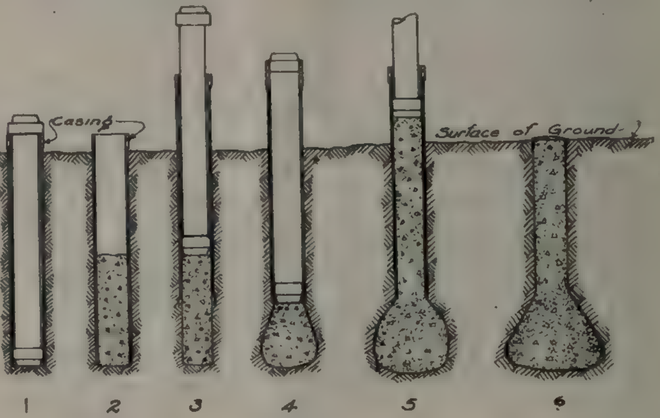


Fig. 1

Regarding the manner in which a pile supports its load by friction, E. P. Goodrich (Trans. A. S. C. E. XLVIII No. 921), points out that "When a pile is supported entirely by frictional resistance, the actual region supporting the load is some deep ground level at which the frictional resistance holding the pile has been transferred through the earth in the shape of a conoid of pressure, the base of which gives a total bearing value equal to the load and a unit bearing value which the earth at that lower level will support. Each kind and degree of compactness will give a different angle for the slope of the conoidal surface."

The values given by Patton for the frictional resistance between the earth and the surface of a pile range from 100 lbs. to 600 lbs. per sq. ft., according to the nature of the soil. Elmer C. Corthell, in his book, "Allowable Pressures on Deep Foundations," gives a summary of a number of actual cases where frictional resistance was measured.

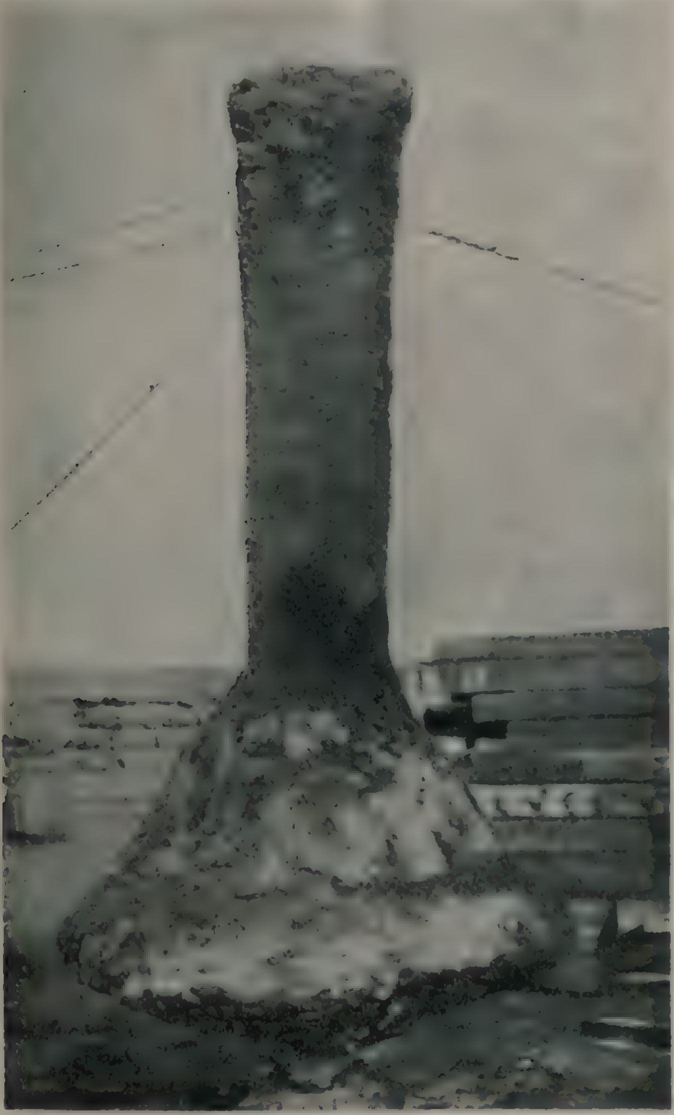


Fig. 2

In firm sand of good quality, Dutch engineers estimate friction on piles at 614 lbs. per sq. ft.

In another section of the same report a summary of data collected shows that in two cases of cylinder piers, the average frictional resistance was 540 lbs. per sq. ft. Gravel gave the greatest resistance and mud the least.

Twenty-three examples of masonary piers showed an average frictional resistance in sand and gravel of 522 lbs. per sq. ft.

Five examples of walls, quays and other structures showed an average frictional resistance of 270 lbs. per sq. ft.

Corthell also gives the following summary of actual bearing values:

The pressure of stable structures on fine sand range from 2.25 to 5.80 tons, average 4.5 tons.

On coarse sand and gravel, 2.4 to 7.75 tons, average 5.1 tons.

Sand and clay, 2.5 to 8.5 average 4.9 tons.

Alluvium and silt, 1.5 to 6.2 average 2.9 tons.

Hard clay, 2.0 to 8.0 average 5.08 tons.

Hardpan, 3.0 to 12, average 8.7 tons.

Clay, 4.50 to 5.60, average 5. 2 tons.

Ira O. Baker gives safe bearing power of soils as.

	Safe bearing power tons per sq. ft.		
Kind of Material.	Minimum.	Maximum	Average
Rock, the hardest, in thick layers in native bed	200	...	...
Rock, equal to the best ashlar masonry	25	30	27.5
Rock, equal to the best brick masonry	15	20	17.5
Rock, equal to poor brick masonry	5	10	7.5
Clay in thick beds, always dry	6	8	7.
Clay in thick beds, moderately dry	4	6	5
Clay, soft	1	2	1.5
Gravel and coarse sand., well cemented	8	10	9
Sand, dry, compact and well cemented	4	6	5
Sand, clean dry	2	4	3
Quicksand, alluvial soils, etc.	.5	1	.75

Cost of Stucco Finish for Concrete House

Data on the stucco finish for the walls of a concrete house built in 1917 in Darien, Conn., are given as follows by Mr. M. D. Morrill in Concrete:

The stucco finish was put on in a single coat about ¼ in. thick, applied with a plasterer's trowel. The walls were not wet down, but all dry dust was removed. The wall surface was left smooth by the steel forms, and it was at first questioned if there was not danger that this thin coat of stucco would eventually peel off. Experience, however, seems to prove the contrary, and on a considerable number of buildings finished in this way six years ago there is no sign of the separation of the stucco. It appears to be a permanent as well as a rather inexpensive way to finish these steel molded concrete walls. After this stucco was troweled on and had been allowed to stand a few minutes, the surface was gone over lightly with a cork float. A little water was thrown on with a brush, as needed, while the surface was being floated.

In order to get at the exact cost of this wall finish, the time and material used on finishing a surface of 142 sq. yd. was kept, no allowance being made for openings.

Labor and Material, 142 Sq. Yds. of Stucco

½ day, 3 masons, at $4.80 for 8 hours	$7.20	
½ day, 2 helpers, at $3.00 for 8 hours	3.00	
½ day, 2 carpenters, at $4.50, scaffolding	4.50	
Total labor		$14.70
2 bbl. cement at $1.92	$3.82	
1 yd. sifted sand at $3.00	3.00	
Total materials		$6.82
Total		$21.52

The total cost of finishing these walls was thus between 15 ct. and 16 ct. per square yard.

It is announced that the Advisory Council for Scientific & Industrial Research has appropriated $1,500 to meet the cost of the equipment for further experiments in the production of gas from straw. The process is one developed by Prof. McLaurin, of the University of Saskatchewan.

Fire Prevention Committee's Report Before American Society of Municipal Improvements

By Alcide Chausse, Chairman

THE following information respecting fire prevention and fire protection, taken from my files, will, this year, replace my usual report:

N. Y. Fire Department

Help us prevent fires!
Carelessness caused 10,000 fires in New York in 1916.
Don't throw away lighted matches or cigarettes. Clean up rubbish.
Don't let children handle matches.
Don't use gasoline near fire. Be careful!

At a point near the Brooklyn bridge subway entrance, of New York city, Fire Commissioner Adamson has caused to be erected a large sign, with above wording, asking for the aid of all New York citizens in a campaign to prevent fires. This sign is placed where thousands, if not millions, see it every day, where it serves to remind readers of their duties to the city, their neighbors and their families.

Prosecution of Incendiaries.

The prosecution of incendiaries in Boston is being continued with unabated vigor. One of the criminals was sentenced during February to the state prison for a term of four to five years. He was convicted of having hired another to burn the house owned by his brother-in-law. The man who actually fired the house confessed also during the trial that he had set thirteen other fires. He testified that in addition to receiving money for setting fire to the property he was paid ten dollars on several occasions by public adjusters for advance information concerning the fire and place of fires to be set.

Automatic Sprinklers.

A recent decision of the New York Supreme Court set forth that the fire commissioner of New York city still has the power to order the installation of automatic sprinklers in cases where his individual judgment deems such protection necessary. This is a reversal of the holding of the New York Board of Appeals, which had ruled that a section of the building code prescribing rules for the installation of sprinkler systems in certain classes of buildings limited the authority of the commissioner to the enforcement of this section. The code holds that the fire commissioners' power has neither been added to nor diminished. The Board of Appeals has the authority, however, to pass upon the order of the fire commissioner to determine its reasonableness.

With the provisions for appeals from the order of the fire commissioner to the Board of Appeals, and also beyond it to the courts, the right of property owners are well protected, while the fire commissioner retains an authority which is no doubt necessary in a city of the character of New York. The commissioner must, of course, enforce such provisions of the building code as require automatic sprinkler systems in certain occupancies.

Every City has a Building Inspector.

Every city in the state of Maine of more than 2,000 inhabitants has a building inspector. This inspector is elected each year by the municipal officers. The inspector has jurisdiction only within such limits as are defined by the municipal officers and these limits must include the thickly settled portion of the city. Towns of less than 2,000 inhabitants may establish the office of building inspector if the voters so decide at an annual town meeting. The election of building inspectors takes place in the month of April.

Spontaneous Ignition.

In his paper, read before the Ohio Firemen's convention, John A. Welsh, chief of the Columbus Fire Prevention Bureau, stated that spontaneous heating and ignition has been known to occur in the following substances: Coal, coke, lampblack, charcoal, sawdust, corkdust, colors, varnishes, laquers, oils, dryers, fats, oilcloths, lime, drill turnings, carbide, nitric compounds, sulphur compounds, hay, grass, malt, bran, hops, wool, cotton, silk flax, hemp jute, tow, oil rags, polishing rags, greasy cloths and clothing in a greasy or dusty condition.

Value of Skylight.

Not so long ago a theatre fire occurred in Logansport, Ind. The fire fighters gave it as their opinion that had it not been for the venilating skylights over the stage, the fire would have spread from the stage to the auditorium and the entire building would have been destroyed. In a discussion at the National Fire Prevention Association Convention, held in May, Rudolp P. Miller, of New York Board of Standards and Appeals, declared that the ventilating skylight is the most important feature of the theatre, and is one that is too often neglected.

He said further: "If satisfactory ventilating skylights are provided, the smoke and gases from a stage fire will go out to the outer air instead of into the auditorium. The experiments made on model theatres one-eighth natural size by Austrian engineers show that whenever the sklight opens the smoke cannot enter the auditorium to an extent to do any particular harm." Edward B. French gave it as his opinion that had the skylight of the Iroquois Theatre been working properly there would have been no great loss of life in that fire.

Film Inspectors

An ordinance prepared by the Indianapolis Building Inspector, in consultation with Fire Marshall H. H. Friedly and insurance experts, provides for the appointment of a film inspector at ninety dollars a month, his hours being one to five o'clock in the afternoon and 6.30 to 10 o'clock in the evening for the purpose of inspecting motion picture places and observing whether the ordinance is being observed. The ordinance prohibits the storing of films, negatives, raw stock, finished products or discarded scrap or used films in any building, any part of which is used for a theatre, dance hall, hotel, church, school, department store, public meeting place, apartment, tenement or residence building for more than one family, or in any building, the nearest wall of which is within fifty feet of another building. The ordinance calls for sprinkler systems in storage places, all films to be placed in individual containers and stored in fireproof vaults. No one is to be permitted to handle such films unless licensed.

Condemning Property

A decision has been given by the Supreme Court of North Dakota which upholds the right of the state fire marshal to condemn property. The fire marshal of that state had condemned property which had been badly damaged at Devil's Lake. Instead of obeying the order of the fire marshal, the owner of the property began repairing the structure, contending that the building had not been damaged to the extent of 50 per cent and that a local ordinance permitted repair in such cases. The fire marshal obtained an injunction restraining the owner from proceeding with the repair work. The supreme court has affirmed decision making the injunction permanent and upholding the fire marshal.

Life Hazard and Sprinklers.

Safety for life is one of the most important services bought with an automatic sprinkler system. During the past year, the Alfred Street School in Binghamton, New York, was protected against fire by an automatic sprinkler system. A timber near the heating plant became ignited during the noon hour and started a blaze. When the heat reached a point near a sprinkler head a deluge of water extinguished the fire before the firemen arrived in response to the alarm. It was just at the noon hour and the children had not entered the building for the afternoon session though the fire occurred only a few minutes before it was time for them to assemble.

Safer Construction of Schools.

Nearly all the efforts that have been made to bring about safer construction of school buildings has been centered on an examination of plans for these buildings after the plans have been made. Fire Marshal J. R. Young of North Carolina has begun a campaign to keep before those who are primarily responsible for school building construction the necessity and the elements of school building safety. Recently Fire Marshal Young sent a letter to the members of all school boards in North Carolina, advising them to consider carefully the subject of safety when ordering the construction of school buildings, and what is more important, to consider the plans for a school building with the state fire marshal department before the plans are believed to be ready for use. In many instances this would save expenses in architects' bills and lead to the closer and more effective co-operation with the state department. Each school board member, in addition to the letter from Mr. Young, received a special pamphlet on the necessity of school building safety and a copy of Mr. Young's address on the double tower stairway. The North Carolina campaign for safer school buildings has received the endorsement of the North Carolina chapter of the American Institute of Architects.

Condemned Wooden Shingles.

None of the presidents of the United States has been more versatile than Thomas Jefferson. Jefferson was an architect of no mean ability. His plans were used in the construction of many buildings. A reader of the former president's correspondence has discovered that he condemned the wooden shingle roof nearly one hundred years ago. In a letter written to explain his plans for a court house, he said: "I would advise you to cover with tin, instead of shingles. It is the lightest and most durable covering in the world. We know that it will last one hundred years and how much more we do not know. The tin and putting on cost 15d. a square, and we were asked here 10d. a square for heart pine shingling. All our buildings except one are covered with tin."

Motion Picture Engineers.

Francis Jenkins representing the society of Motion Picture Engineers, in a brief address before the last meeting of the National Fire Protection Association, called attention to the fact that nearly all public officials had been using their powers exclusively to bring about construction designed to prevent the spread of motion picture film fires, and had expended little effort to prevent the fire from starting. This criticism is amply justified. Old projecting machines and carelessness, either in combination or separately, cause most film fires. The setting of the highest standard for projecting machines in use would eliminate the chief physical hazard causing these fires. Old projecting machines chew the film in small bits, making it almost like wood shavings, causing it to ignite readily if the film remains stationary before the light for even the smallest instant.

Mr. Jenkins also referred to P. W. Nicholson, Fire Marshal of the District of Columbia, as a pioneer in carrying out the excellent idea of doing away with flimsy enclosures about projecting machines being used for temporary exhibition. Mr. Jenkin's point was well made that enclosures of this character only encourage carelessness in the handling of films by concealing the operator from view. If the operator were in full view, he would not be smoking, he would be much more liable to keep all films not in use in metal containers. The temporary concealing booth defeats the purpose which it is designed to fulfill.

Fire Drill.

Any one who has ever watched a fire drill in a large industrial plant has realized the desirability of the fire drill. When large numbers of workers are housed in a small area, even with the best of discipline, escapes become crowded and descent sometimes becomes difficult. What would happen in a building where no fire drill had been held and there was no discipline is too terrible to contemplate.

Frequently inspectors find that building owners have complied with the law by erecting fire escapes, but occupants never use escapes for drill purposes. The fire inspector in Scranton, Harry Henckley, reported recently that one factory where an escape had been on a building for a year and which employed women had never held a fire drill during the entire year. The Scranton ordinance provides that there shall be at least one fire drill each month and adds a penalty for failure to obey. In spite of the terrible results of fire drill failure, a fire drill law is one of the most difficult to enforce. The complaint is usually made that the building occupants become nervous on a fire escape. If they become nervous when there is no fire, and no fire drills are held, what may be expected when fire comes ?

Fire Escapes.

To avoid the probability of being sued for damages by those who may be injured in escaping from a burning building by means of the fire escape, it is necessary that the owner of the building provide fire escapes that are reasonably safe for use. The Minnesota Supreme Court recently upheld the action of a jury in awarding damages for injuries sustained in jumping from fire escapes which it was alleged were insufficient. These fire escapes were attached to the Concord Flats in St. Paul. The flat was destroyed by fire and four women lost their lives. The woman who obtained the judgment went down a fire escape until she was compelled to jump 20 feet. Her leg was broken and the jury awarded a judgment for $2,713.

City Not Liable.

A city owning and operating its own water plant is not liable for damages resulting from a low water pressure when fire occurs. Many business men do not know this to be true and believe that they could obtain damages from the city if water pressure should fail at the time of a fire and lead to destruction of their property. A business man making a careful contract with a privately owned water power company for water supply can make the company clearly liable for failure to maintain a certain pressure during time of fire. But it is not good business judgment to rely on collection of damages for re-embursement of fire losses. The prudent business man will provide all the private fire protection he can afford instead of relying upon public agencies entirely.

Ontario Government Co-operation.

At the end of August a convention was held at the Parliament Buildings, Toronto, Ontario, to discuss fire-prevention plans.

The Ontario Government has decided that this work is one that should be extended considerably, and it is probable that at the next session of the Legislature some amendments will be made to the Fire Marshal's Act, which will give him more power and will help greatly in fire prevention work.

Notices to the number of 2,000 were sent out, signed by the Premier, to all parts of the province, asking those who are interested in fire prevention to be on hand at the conference on August 30th. These notices were sent to manufacturers, fire departments, business men, farmers' representatives and all others who are beginning to realize that fire prevention is one of the best things the province has taken hold of for years.

Comprehensive Building Code.

The most complete and comprehensive building code ordinance for a city of 50,000 inhabitants is that of Davenport, Iowa. This ordinance passed in 1916, has recently been modified and published in book form by Ralph Graham, building commissioner of the city. The code has been arranged in a manner which brings credit to the compiler. All sections are carefully grouped and follow in logical sequence, and in addition a most complete index is provided. Ready accessibility to any part of a building code in which a prospective builder may be interested is most important. Such accessibility makes for a surer and a more satisfactory enforcement of the code itself.

Among the modern requirements of the Davenport code is that on roofing. The use of the wooden shingle roof on new buildings is prohibited over the entire city. The provision became effective July 1. No existing wooden shingle roof, if damaged more than 40 per cent, shall be repaired with other than approved roofing. By approved roofing is meant only that which bears the label of the Underwriters' Laboratories. Underwriters' Laboratories Class C roofing is permitted in the residence sections, but buildings in the fire limits and those outside, of certain occupancy and size must be covered by such material as would rank with Class A or B of the Underwriters' Laboratories specifications.

The code contains requirements for automatic sprinklers and for the storage and handling of explosives and inflammable liquids. All of the principal fire hazards which have been introduced into the cities within the last decade are recognized in the code. The regulations governing the construction of moving picture theatres, film exchanges, garages and dry cleaning establishments are complete in every detail. The enforcement of this ordinance in Davenport is sure to have a marked influence on the fire loss. The ordinance is one of the most advanced in the country for a city of 50,000 inhabitants in its recognition of fire dangers and the proper means of combating them.

Two Valuable Pamphlets.

Fire Marshal E. P. Heaton of Ontario has just issued two pamphlets which will be very valuable in that province in promoting municipal legislation and fire prevention. One of these pamphlets contains extracts from the provincial municipal act, which has to do with the powers of municipalities in respect of fire control legislation. The first part of this pamphlet is taken up with definitions of terms used in the statute extract quoted. Then follows with citation and exact titles a list of the purposes for which municipal councils may pass by-laws looking toward better fire protection and prevention.

Along with this pamphlet which brings before every city official and particularly the city attorney, the fundamental law upon which city councils may act, Fire Marshal Heaton furnishes a second pamphlet containing suggested fire laws for enactment by the towns and cities. These by-laws are set forth in seven sections. The first section contains general precautions against fire; the second, directions for the safe use and installation of stove pipes and chimneys; the third, directions for the storage of coal oil; the fourth, regulations for the sale and use of fireworks, gunpowder, etc.; the fifth, rules governing the location and construction of special hazard occupancies; the sixth makes it the duty of the fire chief to investigate all fires, and the seventh is a firemen's inspection ordinance The great merit of the by-laws which Fire Marshal Heaton has suggested is their brevity and clarity. The entire group of fire laws are set forth in a pamphlet of seven pages, and the ordinances as prepared are devoid of all legal verbiage which tends to obscure rather than make clearer to the layman just what is meant.

Inspection of Theatre Scenery.

A few years ago attendants at the annual convention of the International Association of Fire Engineers listened to an address on "Inspection of Theater Scenery," in which it was proposed that the International Association should formulate certain standards which, if possible, were to be adopted by members and followed by them in their inspection work. It seems that this excellent proposal did not get beyond the discussion stage. According to the semi-annual report of Edward Steinigeweg, chief inspector of the Cincinnati Fire Department to Chief Barney J. Houston, 704 pieces of theater scenery were condemned in the first six months of 1917. Six hundred and forty-seven of these pieces were remedied and accepted upon re-inspection, while 57 pieces were ordered out of the theaters.

The wetting of scenery during changes would account for the necessity of doing some re-fireproofing but for a small proportion only of that which it was found necessary to do to meet Cincinnati standards. The Cincinnati, New York and Chicago Fire Departments use stickers which are pasted upon the scenery pieces to indicate that they are o.k. when they pass inspection. A piece of scenery which has passed inspection in New York or Chicago is in almost every instance satisfactory in Cincinnati, unless the fireproofing of the scenery has been destroyed by water. This is as it should be.

The adoption of a minimum standard test for theatre scenery to be used by the leading cities throughout the country would materially facilitate this work among fire departments, would insure greater safety in theatres and would also bring about a more hearty co-operation with theatre property men. The necessity for condemning a large number of scenery pieces in a few towns is clear evidence that inspection in many others is lax, faulty or is based on different standards of safety.

Safety in Apartment Houses.

Opinion was expressed at the National Fire Prevention Association convention in Chicago, that the construction regulations governing construction of hotels usually call for a better type of building which is safer for occupants than is demanded for apartment buildings. The point was made that hotels are usually filled with vigorous people, well able to take care of themselves. Apartment houses frequently house invalids and children. Many apartment buildings are equal in size and capacity to the moderate-sized hotel, and people permanently housed in one place are entitled to safety as much as those who are located temporarily in hotels.

As in every other building, the construction feature lending itself most readily to rapid spread of fire in hotels and apartment houses in the vertical opening. Even where there is an exceedingly small amount of frame trimming, fire will spread through vertical openings with terrible rapidity. This was well illustrated in the Lennox Hotel fire in Boston,—the hotel building of fire resistive construction,—where the fire spread only because of a small amount of wood. The first requisite for making hotels and apartment houses safe against the fire hazard for occupants would be to close all vertical openings or make arrangements so that openings would be closed in case of fire. There is not only the danger of the fire spreading upwards, but, what causes more deaths than the actual upward spread of the fire, the danger of upward spread of smoke, which closed openings would prevent.

Sidney J. Williams, chief inspector for the Industrial Commission of Wisconsin, insists that there should be no obstructions whatever to hotel fire escapes. In Wisconsin, any door to rooms through which persons must pass to fire escapes must be taken off. In many hotels it is customary to see painted in red on room doors a sign saying, "in case of fire break the glass." As Mr. Williams said, it would be difficult to find these doors if the halls were filled with smoke and one were crawling on his hands and knees in order to obtain sufficient air; and even if the doors were found, it would not be an easy or pleasant task to kick out the glass. It is a vital point to remember in considering the construction of all buildings from the exit viewpoint that stairways and fire escapes do not measure the emptying capacity of a building unless there is adequate access to these avenues of escape.

Blind alley stairways were severely condemned by inspectors at the convention. In many hotels stairways from upper floors are carried down through the building in a direct line until the mezzanine or second floor is reached, where, if a stranger finds himself in the back part of the hotel, he is lost as to where to seek a way out. When the attention of one hotel proprietor was brought to this condition, he declared that back stairways, allowing easy access from the building, could not be approved in hotels because these stairways would be used to escape payment of bills. The manager of the LaSalle Hotel in Chicago declared that this is not a valid reason for building a stairway in that way, as it was just as easy to get away without paying a board bill out of the front door as out of the back door. An examination of hotels disclosed that many of them have these stairways which it is impossible to follow to the outside.

Hazards to Life and Property Created by War.

The National Fire Protection Association, assembled in Chicago, on May 9th - 11th, 1918, for its twenty-second meeting, again called attention to the unusual hazards to life and property created throughout America by the world war. These hazards demand the utmost vigilance and initiative not only from those in authority but from the private citizen as well. Every individual should consider himself a fire warden of the nation at this critical time and should equip himself to serve his country by safeguarding to the extent of his intelligence and ability every form of natural and created resource. The elimination of waste, at all times the duty of good citizenship, is at this moment our profoundest public and private responsibility.

In its warfare against the needless sacrifice of human lives and property by the fire the Association advocates the following measures:

1. The adoption by municipalities of the Standard Building Code of the National Board of Fire Underwriters to the end that fire-resistive building construction may be encouraged, the use of inflammable roof coverings prohibited, adequate exit facilities from buildings assured, and interiors so designed and fire-stopped as to make easy the extinguishment of fires therein.

2. The adoption by all states of minimum building requirements for the protection of state and county hospitals, schools, asylums and similar institutions outside city limits and of small communities in which the establishment and enforcement of a building code is impracticable.

3. The enactment by each state of the fire marshal law advocated by the Fire Marshals Association of North America to the end that official investigation may be made of the causes of all fires, preventable fires may be eliminated by public education, and the crime of arson stamped out.

4. The adoption of the Association's suggested ordinances providing for the systematic inspection of all buildings by city fire marshals or local firemen to insure the vigorous enforcement of rules for cleanliness, good housekeeping and the maintenance of safe and unobstructed exits, fire-fighting apparatus and other protective devices.

5. The enactment of ordinances similar to that of Cleveland, Ohio, fixing the cost of extinguishing pre-

ventable fires upon citizens disregarding fire prevention orders, and a more general legal recognition of the common law principle or personal liability for damage resulting from fires due to carelessness or neglect.

6. The wider general use of the automatic sprinkler as a fire extinguishing agent and life saver and the more general adoption of the fire division wall as an important life saving exit facility.

7. A careful study of the technical surveys of cities made by the engineers of the Committee of Fire Prevention of the National Board of Fire Underwriters covering the items of water supplies, their adequacy and reliability, fire department efficiency, fire alarm systems and conflagration hazards, and of the possibility of co-operation among neighbouring cities through mutual aid and the standardization of hose couplings.

8. The adoption of the Association's suggested laws and ordinances for state and municipal regulation of the transportation, storage and use of inflammable liquids and explosives.

9. The universal adoption and use of the safety match and legislation prohibiting smoking in all parts of factories, industrial and mercantile buildings except in such fire-proof rooms as may be especially approved for the purpose by fire departments.

10. The education of children and the public generally in careful habits regarding the use of fire.

11. The co-ordination of all these activities through a central administrative officer or body of the state or city having primary jurisdiction, for the purpose of promoting uniformity of action and efficient co-operation.

In the furtherance of these objects the Association appeals for the co-operation of all citizens. It asks them to help in the dissemination of its valuable literature and in the use of the standards of fire protection so carefully worked out by its committees to the end that the lives and substance of our people shall not continue to be dissipated by a reckless and easily preventable waste.

Cleaning Soot from Smoke Stacks with Blasting Powder

A SIMPLE method of cleaning out soot from large smoke or kiln stacks by shooting the stack with a special type of gun and FFF blasting powder is described in Engineering and Contracting. It is stated that this method can be used in cleaning either lined or unlined stacks, brick or steel, without any fear of injury to either the stack or the lining.

The gun can be made out of an old piece of shafting about 4 in. in diameter and 14 in. to 16. long. Bore a hole 1¾ in. in diameter and 10 in. long in the center of the piece. Then bore a small horizontal hole ¼ in. in diameter through the piece to the bottom of the center bore. This hole serves as a touch hole for inserting the fuse. The whole thing can be mounted on a pedestal about 6 in. in diameter so that it will stand in an upright position.

The method of operation is as follows: Pour some FFF blasting power into the mouth of the cannon to about 2 in. from the top. Tamp to the collar with dry clay. A short piece of fuse is inserted in the touch hole and in contact with the main powder charge. Open the flue door at the bottom of the stack, set the cannon on the bottom and in the center of the stack, light the fuse and close the flue door.

The explosion shakes and loosens the soot adhering to the sides, causing it to fall to the bottom. It can then be removed through the flue opening.

A charge of 8 in. of FFF powder, 1¾ in. in diameter, is sufficient for a stack up to 100 ft. high and 4 ft. in diameter, or over. The number of shots necessary to thoroughly clean a stack depends upon its condition if very dirty it may require more. The size of the charge and length of the cannon can be regulated to suit the height and diameter of the stack.

One of the largest manufacturing concerns in the country has used this method for several years, without an accident or injury in any way to the stacks.

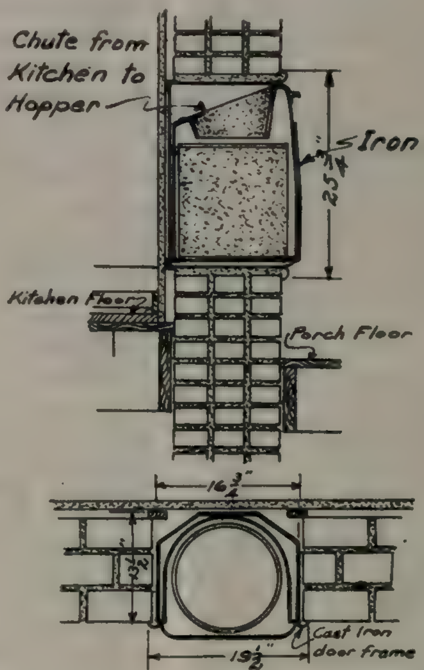
Mr. Tissington Goes to Coleman Co.

Mr. Frank Tissington, recently engineer of Archibald & Holmes, Ltd., contractors, Toronto, has severed his connection with that firm to take up new duties with the Coleman Fare Box Co., Ltd., 1191 Bthurst Street, Toronto, as manager. The latter manufacture the portable and stationery "Pay as you enter" fare boxes in use on all the street railways and radials in Canada, in addition to many of the street railways in the States and other parts of the world. The Coleman Fare Box Co., Ltd., also control the Coleman Tool, Die & Stamping Works, located at the same address.

Build In the Garbage Can

Your clients will appreciate your building a garbage can into the wall for them, instead of having to have it on the back porch in the way.

Such a garbage can is illustrated herewith. It is durably made of metal and its operation is very simple, and permits ready access to the pail inside. It is proof against flies, cats, dogs and odors, and protects garbage from frost in winter and fermentation in summer.



Rapid Work on Ammunition Plants

Anglins, Limited, Montreal, who make a specialty of the rapid construction of factory buildings, recently carried out contracts for two ammunition plants in the north end of Montreal. The buildings are, of course, of a utilitarian type. They were built for Messrs. Caron Bros. and for the Lymco Corporation, Limited.

The plant for the former, illustrated in Figs. 1 and 2, is situated at the corner of Lannes Street and Esplanade Avenue. The over-all dimensions are 500 x 100 feet, with an office section on the front, 100 x 40 ft. The factory proper consists of one storey, and the office portion of two storeys. The foundations are of concrete, and the superstructure of 12 in. brick, with 16 in. pilasters and concrete caps. The columns and girders carrying the saw tooth trusses are of reinforced concrete.

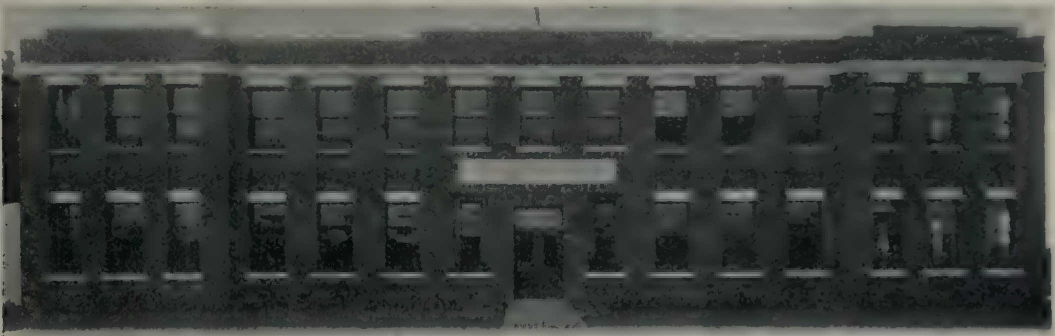


Fig. 1—Frontage view of building for Caron Bros.

The roof is of the saw tooth type, made up of B. C. fir, trusses, and 3 in. mill roofing; the finished roof on the sloping portions is covered with mastic, and the flat parts with tar and gravel. The exposed ends of the saw tooth are covered with slate. The drainage of the roof is through the interior, the water being carried to the ground in 4 in. cast iron drains, connected at the floor line to tile drains of the required sizes carried out to the main sewer.

The floor consists of 6 in. concrete, cement finished, marked off in squares and rolled. A series of concrete trenches were constructed at the same time as the floor, these being for the purpose of carrying off the cutting fluid to a main collecting basin, from which it is pumped back for re-use. Heating is by means of a low pressure steam system.

Alongside of the main structure is a building specially designed for the heat treatment work, necessary in the making of shells. This is of 12-inch brick walls, having a steel truss roof, and a monitor roof; the roof is covered with corrugated galvanized iron, while both sides of the monitor roof have louvres made of galvanized iron for ventilation purposes.

All windows are of the double hung wood type; the glass of the windows proper consists of ⅛-inch factory ribbed glass, and the glass for the saw tooth sash ¼-inch ribbed glass.

For the offices, Indiana limestone was used on the front elevation and returns, in order to introduce an element of attraction and to relieve the building from the severity which is present in most factory buildings. The floors in this part of the plant are of hardwood. The walls and ceilings are of plaster.

Drinking fountains have been placed conveniently for the men throughout the plant, while the lavatory accommodation is convenient and up to date.

Work was commenced on May 18 last, and the plant proper was turned over to the owners for installing machinery on July 6.

The architects are Messrs. MacVicar & Heriot, Montreal.

The plant of the Lymco Corporation, Ltd., Fig. 3, on Esplanade Avenue, Park Avenue Extension, is from plans by Mr. Alphonse Piche, Montreal, and consists of a two-storey building 240 x 60 ft.; a one-storey heat treatment building at the north end, 50 x 60 ft. by 20 ft. high; two-storey extensions for lavatories at the rear, 20 x 36 ft.; together with separate transformer house, boiler house, and storage sheds.

The foundations are of concrete, the exterior walls being of brick. The ground floor of the main structure is of 6 in. concrete and cement finish, and the upper floor a combination of 2 x 3 mill flooring and hardwood carried on B. C. fir columns and beams. The roof is of mill construction, consisting of a combination of B. C. timbers and of 2 x 3 spruce covered with

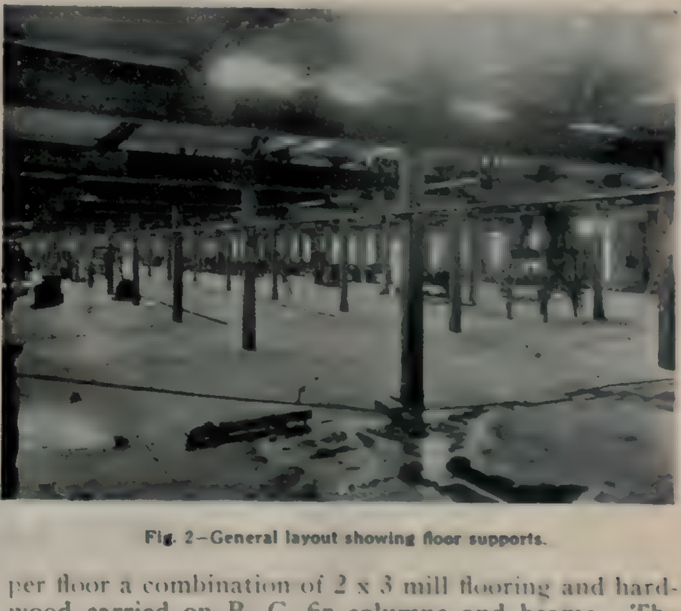


Fig. 2—General layout showing floor supports.

4-ply tar and gravel. The windows are double hung, the glass being double diamond.

The heat treatment building is 20 ft. high from the ground to the under side of the concrete roof. The walls are of brick and metal sash. The roof is surmounted by a large square monitor, with the sides of metal sash; the main roof rises to the monitor from four sides, thus securing the best possible ventilation.

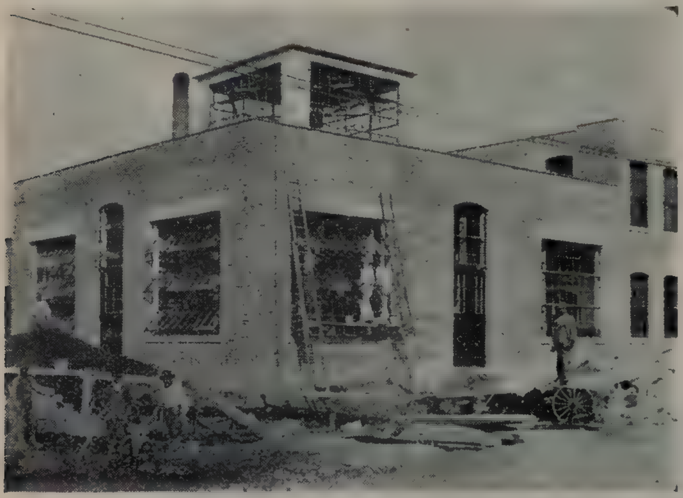


Fig. 3—New home of Lymco Corporation, Limited.

A portion of both floors at the south end of the factory, covering an area 60 x 40, are used for offices, the partitions being made of wood and glass, in order to give ample light.

Building operations were commenced on June 25, and the owners were in a position to install machinery on July 30, 1918.

The sub-contractors employed were as follows:—Roofing, Metal Shingle & Siding Co., Ltd.; Napoleon Turcot, Limited. Plumbing and heating, Napoleon Turcot, Limited; T. Lessard & Sons. Mill work, Wm. Rutherford & Sons Co., Ltd. Painting, Messrs. O. Guilbault; Alexander Craig, Ltd. Ornamental iron, John Watson & Son. Structural steel, Dominion Bridge Company.

The Federal Board of Vocational Education, Washington, D.C., has issued bulletin, No. 15, entitled, "The Evolution of National Systems of Re-education for Disabled Soldiers and Sailors." The bulletin has been written by Douglas C. McMurtrie, at the Red Cross Institute for Crippled and Disabled Men. The bulletin contains 300 pages of most interesting matter to anyone concerned with the re-education of our returned soldiers.

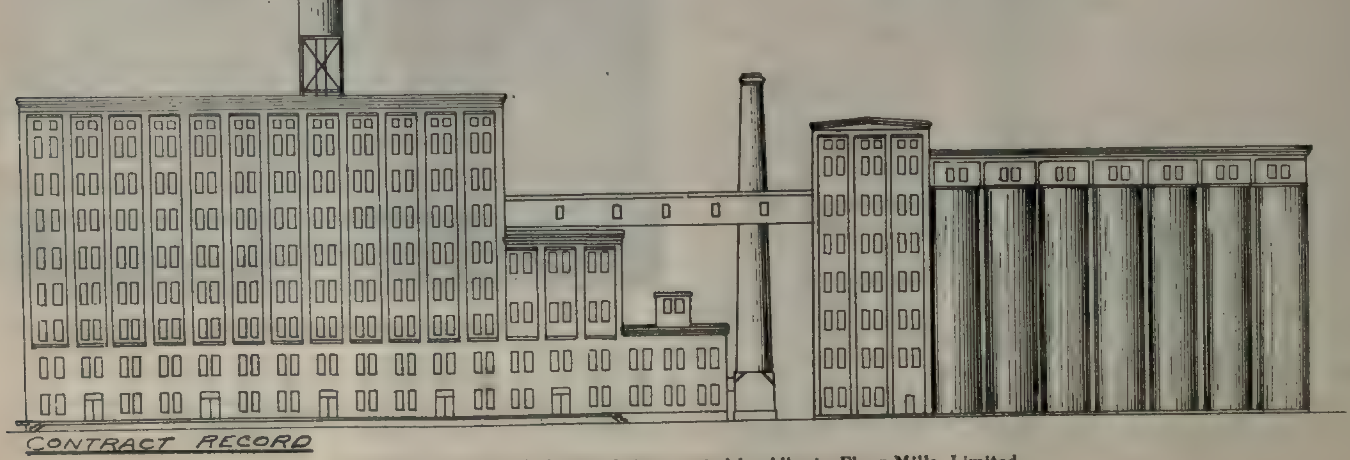
Hot Water Transmission

With a 12-in. pipe properly lagged, water at a maximum temperature of 160 deg. Fah., moving at 3 ft. per second, can be transmitted four miles, with a loss of only 13 per cent. Delivered at 140 deg. to 120 deg. Fah., this hot water would serve for the heating of all communal types of buildings, and for all cleansing purposes, and could be economically re-heated to boiling point by electricity. Heating water from 50 deg. Fah. by electricity cannot compete with heating by combustion, obviously because high-grade heat takes as much fuel to develop its 30 per cent. as low-grade heat takes to develop the whole 100 per cent.; if the 30 per cent. is reduced to, say, 22 - 25 per cent., in order to make the bulk, or as much as necessary, of the 70 per cent. available, there is no justification for a separate scheme for each. The "Engineer" mentions a scheme for combined high-grade heat by means of "bleeder" turbines—tapping the steam at such a vacuum as corresponds to the hot-water temperature required.

The first of the 10,000-ton concrete barges being constructed for the Department of the Controller of Merchant Shipbuilding, was successfully launched on Sept. 21 at Barrow, England.

Big Flour Mills for Calgary

THE sketch herewith shows an elevation of a big plant being erected at Calgary, Alta., by the Alberta Flour Mills, Ltd. The dimensions of the building are 572 ft. long x 105 ft. deep and 150 ft. high. The capacity of the plant will be 6,000 barrels. Work has not progressed very far as yet, and it is anticipated that over a year will be required to complete it. The operations are being carried out by day labor under the supervision of Mr. Alexander Ingraham, chief engineer for the company, and extensive plant is being employed to reduce manual labor to a minimum. Blacksmith, carpenter and finishing shops have been erected on the site. The proposition represents an investment of $3,000,000 and should mean much to Calgary from an industrial standpoint when it is completed.



Elevation of mill and elevator being erected by Alberta Flour Mills, Limited.

What the Coming Victory Loan Means to Every Class in Canada

By Mr. E. R. Wood

One year has elapsed since we prepared to subscribe the first Victory Loan (our fourth loan) issued in November, 1917. We then realized clearly, and for the first time, that Great Britain had reached the point at which she was compelled to borrow funds in the countries in which she is making her war purchases. This was, and is, an extremely important consideration for Canada, because our activities, prosperity and assistance in the war, depend almost entirely on our ability to market our factory and farm products in the United Kingdom.

When we were asked to subscribe to the Victory Loan, we were enjoying what we may term the prosperity of war, due to the vast volume of orders placed in Canada by the United Kingdom. These war orders were, and are, the backbone of our general position.

We were faced also with certain results of the entry of the United States into the war. The most serious was the closing of that money market to our financial requirements. During 1915 and 1916 Canada was able to subscribe the greater part of its war loans, leaving a portion of them for subscription in the United States which also financed a large part of our ordinary requirements. The new situation created the necessity not only of making Canada's 1917 Victory Loan an unqualified success, but also of financing the Provincial Governments, municipal and corporation requirements, in addition to taking up maturing obligations in the United States. Those obligations in ordinary times, would have been renewed in that country.

With the subscription of a large Victory Loan in prospect, and these serious financial factors governing the situation, the market for bonds other than war issues was at a complete standstill, and the outlook was not good.

The trend in the financial position in the United States during the past 3½ years so far as Canadian borrowings are concerned, is shown in the following table:—

1915	$110,508,000	$64,094,000	58
1916	80,014,000	57,610,000	72
1917	32,404,000	8,425,000	26
1918	61,005,000	1,700,000	2.78

When the United States entered the war, in April, 1917, we were therefore faced with two important factors, namely, that Great Britain could not pay cash for her purchases in this country and that the United States could not longer help to finance Canada.

That was the delicate and dangerous situation. The success of the Victory Loan met that situation completely.

Cause of Great Business Activity

The great business activity resulting from the issues, created additional funds for investment. In due course, it afforded sufficient surplus funds in our own country to finance, not only the requirements of war, but also credits for the United Kingdom and loans to our provincial governments and municipalities. During the first eight months of 1918, Canadian investors having taken the large Victory Loan of last fall, have also been able to finance our province and municipalities to the extent of $60,000,000, as mentioned above. In addition $50,000,000 of the 1917 Victory Bonds have changed ownership, being bought by bona fide investors from holders who found it necessary or desirable to lessen their holdings. This wide and continued interest in the Victory Bonds is no doubt due to some extent to the fact that the Canadian people have been educated by the Victory Loan campaign to invest their savings in Dominion Government Bonds.

It ought to be clearly understood that in approaching our next Victory Loan, we are faced with an equally serious situation. Only by the complete success of our 1918 Victory Loan can we continue to finance our requirements and carry on generally in the way we have during the past seven months.

Gave New Lease of Life to Dominion

The remarkable over-subscription of the 1917 Victory Loan completely changed the uncertain outlook which prevailed when the Loan was offered to the public. It gave a new impetus to agriculture, commerce and prosperity. It invigorated our efforts in the war. It allowed, as already stated, our Provincial Governments, municipal and other borrowers to finance their requirements at home. In short, it gave another lease of life to the activities of the Dominion

A Boon to Canadian Farmers

For the farmer, the Loan was able to finance the only purchaser who could buy his excess products, namely, Great Britain. In the fiscal year 1915, our farmers exported animal produce and agricultural products valued at $209,000,000. For the fiscal year ended 31st March, 1918, they exported no less than $740,000,000 worth of their output, the largest agricultural exports from this country on record.

Manufacturer Prospered by It

For the manufacturer the Victory Loan continued to give the best export market he had ever possessed. Canadian manufacturers during the fiscal year ended 31st March, 1915, exported $85,000,000 worth of merchandise. That period included nearly eight months of war. For the twelve months ended March, 1918, they have exported over $636,000,000 worth of merchandise, an increase in three years of $551,000,000, or 648 per cent. It is interesting to note in connection with these exports that since the Loan was raised, approximately $20,000,000 per month have been advanced to the Imperial Munitions Board at Ottawa for the purchase of Great Britain in this country. There have also been expended approximately $20,000,000 a month for other war purposes in Canada, including large purchases of farm products. This is a monthly total of $40,000,000 or, during the seven months from December, 1917, to June, 1918, a sum of $280,000,000.

950 War Contracts

While the entire farming community has shared in the war orders, all the manufacturers, naturally enough, have not been benefitted directly. Even so, contracts have been given to 950 manufacturers, and in July, 1918, 400 manufacturers were in actual contract relations with the Imperial Munitions Board at Ottawa.

Up to June, 1918, our manufacturers have produced over 60,000,000 shells, 20,000,000 fuses, 74,000,000 lbs. of powder and 50,000,000 lbs. of high explosives.

Of the 1,654,000 tons of steel used in our war work, 1,400,000 tons were produced in Canada.

Contracts have been let in Canadian shipyards for 90 steamships with an aggregate dead weight tonnage of 375,000 tons. These orders have a value of $71,000,000.

National war plants have been established at a cost of

$15,000,000 in Montreal, Renfrew, Trenton, Toronto and Parry Sound, where powder and high explosives are made, fuses loaded and forgings produced and aeroplanes built. These plants have been given their contracts by the Board at the same prices and on similar terms as the independent makers of munitions and they have already amortized their cost to the extent of $10,000,000.

Large quantities of fir and spruce are being purchased by the Imperial Munitions Board in British Columbia for aeroplanes. The Board now has 67 logging camps in operation.

Made Possible Big U. S. Orders

As a collateral advantage to Canada, by reason of the development of capacity to manufacture in a large way, the United States have found it to their advantage to place orders for the production of munitions in Canada to an important extent; the United States supplies all the raw materials, Canada supplying the labor and experience. The benefit of this to the United States, as well as to Canada, will be understood from the fact that the 75 millimetre shell, which is the size for which the largest number of orders have been placed, both in the United States and Canada, were produced in Canada last month in a quantity in excess of the total production in the United States. The production of this size of shell in Canada now on account of the United States Government is 255,000 per week and is steadily increasing.

As a further evidence of the interest of the United States in the developed capacity of Canada, representatives of the marine section of the Imperial Munitions Board were asked to attend a conference called by the Emergency Fleet Corporation of the United States in Philadelphia on the 21st of June, for the purpose of ascertaining what assistance Canada could give to them in the production of marine engines and marine supplies. Already large orders have been placed in Canada for marine castings and winches, and general supplies for the shipbuilding program in the United States. Of course, it is obvious that this business from the United States will have a marked effect upon the exchange situation, as the money is practically all for wages, as the material is practically all from the United States.

Labor Demand Maintained

The success of the Victory Loan insured a continued demand for all kinds of skilled and unskilled labor. High wages have been received and have helped to cope with the increased cost of living resulting from the effects of war for a long period. Agricultural, factory and other labor have earned good wages, giving a margin for saving.

The placing of $400,000,000 by the subscribers to the Victory Loan, in the hands of the Government, enabled the authorities to continue to finance the basis of our prosperity, namely, war orders from the United Kingdom. It assisted them also, to a marked degree, in seeing that Canada does its full part to support our troops at the front, to help feed the Allies, and to bring the war to a successful conclusion as speedily as possible.

The flotation of the Victory Loan, in short, has kept in motion and in good running order the complex, economic machinery of the country.

New Loan Must Be Over-subscribed

Now with regard to Canada's 1918 Victory Loan, it is imperative that it should be well over-subscribed and even more successful than the 1917 Loan.

This is necessary, firstly, because we cannot continue to do our part in the war without the required funds; secondly, because we cannot obtain those funds unless the national activities are maintained at high pressure; and thirdly, because that end cannot be accomplished unless we finance the national activities which have such a vital bearing on the international situation and the conclusion of the war.

It would be a disastrous error were we to be lulled, because of our prosperity, into a misunderstanding of the real situation. It cannot be emphasized too frequently that the safety of our national structure and our participation in the war, depend entirely upon the results of the 1918 Victory Loan.

Our Prosperity Depends on It

Our prosperity during the past year was a direct result of the response to the loan issued last fall. The continuance of our prosperity during the coming year will depend upon the degree of success achieved by the Victory Loan of 1918. Unless we do even better than a year ago, we will jeopardize the prevailing prosperous conditions and activities which, in turn, allow us to participate freely in the conduct of the war.

There is not a legitimate reason why on this occasion we cannot better the results of the previous Loan. We have done well in the past, both in the aggregate and per capita. At the same time, we realize that our position in Canada is a fortunate one, compared with that in European countries which are in the immediate zone of war. No one can reasonably contend that we have yet achieved the best possible results in regard to the raising of War Loans. The evidence of better latent efforts are apparent on every hand. It remains only to organize and give effect to them. For example, while the total bank deposits in Canada on the 30th of November, 1917, were $1,547,000,000, they had decreased to only $1,541,083,788 on 31st July, 1918, a comparatively trifling decline of under $6,000,000, while the deposits in Canada at 31st July, 1918, are $160,000,000, greater than 31st July, 1917. This excellent record was achieved despite the subscription of the 1917 Victory Loan of $416,000,000, despite the absorption of $50,000,000, of those bonds sold by holders during this year, who desired to realize, and despite the purchase by our investors of $60,000,000, provincial and municipal bonds. These are substantial indications of Canada's ability to subscribe another large Victory Loan, because the national activities allowing the nation to make such a record as outlined above, have continued in a marked degree, making it possible to repeat and better the 1917 Victory Loan and general record of the country.

We Must Finance British Purchases

Great Britain having borne a tremendous burden of war for four years cannot be expected to finance her war purchases in this country. The United States is perfecting a vast war machine. Her financial resources are required for that purpose and to place credits at the disposal of the Allies. It is necessary, therefore, that Canada should raise the funds required, not only to carry on our normal and war activities, but also to advance substantial sums to Great Britain for her purchases here.

While in the United States, the people have been asked to subscribe a Liberty Loan every few months, we, in Canada, have not been asked to subscribe a war loan since November, 1917. This is an enormous advantage in every way. The long respite from War Loan activities, has enabled the 1917 Victory Loan to be splendidly absorbed and distributed, has in addition created a healthy market for provincial and municipal bonds, and has allowed business generally to proceed without the temporary halt which war loan issues always bring. Furthermore, it is not too much to say that the maintenance of the market price of the 1917 Victory Loan at the issue price and the recent advance in the issue price constitute a record in war finance.

If satisfactory results are achieved with Canada's 1918 Victory Loan, the funds raised thereby will supply our needs for another year. That is an additional reason why every effort should be made to make the Loan an unqualified success.

Mainly Constructional

East and West—From Coast to Coast

The Universal Construction Co., Ltd., has been incorporated with a capital of $250,000, head office at Victoria, B.C.

Fire of unknown origin destroyed the Pere Marquette Railway bridge over a creek at Ennett Station, Ont., recently.

Columbia Iron & Steel Company, Ltd., has taken out letters patent of incorporation; capital, $25,000; head office, Vancouver.

It is announced that the government has appropriated $175,000 for a unit of the proposed technical school in Hamilton, Ont., this unit to be used in the vocational training of returned men.

The Northern Bolt, Screw & Wire Co., Owen Sound, Ont., are erecting an addition to their plant. The new building will be two storeys high, 101 ft. x 40 ft., and will be covered with corrugated iron.

Harper Gross, Limited, is the name of a recently incorporated concern, which is authorized to carry on a general contracting business. The company has a capital of $10,000, and its head office is at Prince George, B. C.

It is stated that four new flour mills will be erected in New Brunswick—at Grand Falls, Perth, Chatham and Pinder. Mr. Geo. Pinder will build the mill at Pinder, and Mr. G. Chas. Reinsborough is back of the proposed mill at Chatham.

W. A. Brown, Ltd., is the name of a new concern recently organized to take over the plumbing and heating business hitherto carried on by Mr. Wm. A. Brown, now deceased. The company's capital is $50,000, and its head office is at Vancouver.

The building permits issued in Regina, Sask., for the first nine months of this year reach the handsome total of $912,290, as compared with $353,370 for the same period in 1917. September's figures are comparatively small, $20,600, as against $22,700 in the same month last year.

As a result of an increase in employees wages, the water rates in St. Thomas, Ont., have been raised 10 per cent., with a minimum house rate of $5 per annum. The meter rates were increased from 12c to 15c per 100 cu. ft., the minimum charge being $1.50 per quarter with the usual discount.

The building permits issued in Welland, Ont., for the month of September amounted to a value of $11,735, as against $21,800 for the same month last year. The total for the first nine months of this year is $401,479, which compares very favorably with last year's total of $205,180 for the corresponding period.

In the month of September there were 95 building permits, at an estimated value of $205,850, issued in the city of Vancouver, as compared with 47, valued at $36,990, in the same month in 1917. This year's total up to the end of September is 653 permits, valued at $1,217,168, while for the corresponding period last year the total was 406, at a value of $442,910.

The board of trade of Hamilton, Ont., suggests the south end of the Gage park property in that city as a site for buildings to be used by the International Live Stock, Dairy and Poultry Exhibition. A committee of the International Live Stock Association will shortly visit Hamilton, and a number of other cities in search of a desirable place at which to hold their exhibition and a suitable site for their buildings, and if the city council give their consent to the use of the Gage property, it is possible that Hamilton may be chosen as the location for their annual fair. The proposed buildings would be erected with collapsible partitions so that they could be used for other purposes during the year, and it is planned to erect a pavilion to seat at least 5,000.

A recently-organized concern, in which Mr. W. N. Macdonald, of Sydney, is interested, is building a 400-ton concrete steamer at North Sydney, and it is expected that the vessel will be ready for launching early in November. It is 130 ft. long, 12 ft. deep, with a 27-foot beam. The local company also intend to build a concrete floating dry dock, capable of carrying 5,000-ton craft.

There is considerable construction work under way in and around Princeton, B.C. A number of houses are being built. The Canadian Copper Co. are erecting a big concentrator, and are also building a number of houses. W. P. Tierney & Son, railroad contractors, are laying steel up to the company's mine. They have about 800 men divided into five camps and working on the construction of 15 miles of line.

Two big real estate deals which foreshadow large construction undertakings have recently been negotiated in Montreal. The Canada Cement Co. have bought the race track property in the northeast end of the city, known as Delorimier Park, at a cost of some $250,000, and a tract of land across from the race track, comprising about thirty acres, has been acquired by the Canadian Consolidated Rubber Co., the price being in the neighborhood of $340,000.

Harrison & Lamond, industrial engineers, will locate on the industrial island, Vancouver, at the west side of Granville St. bridge on lot 3, where they propose erecting a large work shop to house all their equipment. This firm, which was organized in 1902, under the name of Harrison & Wall, has carried out considerable important building work in British Columbia. It now plans to specialize on road work, in which connection it may be noted that it has made application for patent rights on a new machine for road-making purposes.

Personals

Mr. J. R. Caswell has been appointed division engineer of the C. P. R., replacing Mr. Silliman, who has resigned.

Mr. T. A. Treleaven, master car builder, in charge of the G. T. R. car shops at London, Ont., and the car department of the Ontario lines, has resigned his position and retired, after forty years continuous service in the employ of the company.

Mr. John Coyle, who for about ten years has been manager of the Dominion equipment and Supply Co., of Winnipeg, has organized a new firm to be known as the John Coyle Co., with office in the Curry Building, 208 Notre Dame Avenue. This concern will handle new and used equipment and machinery.

Mr. John Lessard, C.E., of the Highways Dept. of the Province of Quebec, has been engaged in the survey of alternative routes for the Gouin Highway. The suggestion has been made that this road, instead of following the Gatinea River towards Wakefield, should pass through Ironside and Meach's Lake, thus avoiding all the railroad crossings and traversing a beautiful lake country. Near Wakefield the route swings towards the west and then towards the Ottawa river, where two other alternative routes present themselves; one along the base of the hills and joining the out-going route some distance above Hull, and the other swinging down to the Ottawa River through Breckenridge and Eardley to the town of Aylmer.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

London, Ont.
City Council will construct low level intercepter and sewage pumping plant, also sewage disposal works costing $300,000. Engineer, H. A. Brazier.

Moose Jaw, Sask.
Plans are drawn for addition to water works costing $110,000 for City Council. Engineer, Geo. D. Mackie.

Toronto, Ont.
Tenders close October 21st for water mains for the Township Council. Engineer, F. Barber, 40 Jarvis St.

Railroads, Bridges and Wharves

East Williams Township, Ont.
Tenders will be called shortly for the construction of bridge for the Township Council. Engineer, Chas. Talbot, County Bldgs.

Smithers, B.C.
G. T. P. Ry., Montreal, contemplates the construction of large coal bunkers. Local superintendent, A. Kilpatrick, Smithers.

Toronto, Ont.
Footings are in for a $10,000, two-storey, tile and brick freight shed for G. T. Rly., Union Station.

Tenders are being received until October 19th for grading team tracks, Cherry St. Yard, for the C. N. Ry. Chief engineer, A. F. Stewart, 68 King E.

CONTRACTS AWARDED

Alberni Island, B.C.
Bridge for Department of Public Works, Victoria: General contractors, Robertson & Partners, Ltd., 806 Metropolitan Bldg., Vancouver.

Bagotville, Que.
Concrete bridge costing $10,000 for Town Council: General contractor, The Provincial Building & Engineering Co., 83 Craig St. W., Montreal.

Carillon Canal, Que.
Rebuilding portion of pier costing $9,000 for Department of Railways and Canals, Ottawa: General contractor, W. Dore, Valleyfield, Que.

London, Ont.
Steel and concrete bridge costing $22,000 for City Council: General contractor, Reid & Brown Structural Steel & Iron Works Ltd., 63 Esplanade E., Toronto.

St. Ann, Que.
Concrete bridge costing $10,000 for the Town Council: General contractor, Riverin & Riverin, Chicoutimi.

St. Hedwidge, Que.
Steel bridge costing $14,000 for Town Council: General contractor, Marcoux & Delisle, Roberval.

St. Leonards, N.B.
Round house and bunk house costing $10,000 for National Transcontinental Rly.: Engineer and general contractor, Henry Post, Woodstock, N.B.

St. Prime, Que.
Steel bridge costing $7,500 for Town Council: General contractor, Marcoux & Delisle, Roberval.

Toffino, B.C.
Repairs to wharf for Department of Public Works, Victoria: General contractor, McDonald & Watson, Victoria.

Vancouver, B.C.
Wharf costing $120,000 for Department of Public Works, Ottawa: General contractor, Hodgson & King, 626 Pender W.

Public Buildings, Churches and Schools

Esquimalt, B.C.
Plans are in progress for extension to military hospital for Department of Public Works, Ottawa. Secretary, R. C. Desrochers, Ottawa.

Fredericton, N.B.
Tenders are being received by R. C. Desrochers, secretary of Department of Public Works, Ottawa, until noon, October 22nd for construction of vocational building, boiler house, disinfecting plant, and alterations to old Government house and ward, Unit "B" military hospital buildings.

Galt, Ont.
By-law is to be submitted for the construction of G. W. V. home costing $15,000, for City Council. Engineer, W. H. Fairchild.

Humboldt, Sask.
Plans are to be prepared for $10,000 addition to hospital for Sisters of St. Elizabeth.

Lower Kingsburg, N.S.
Breakwater, skidway and boat house for Department of Public Works, Ottawa: General contractor, Donald Sutherland, Jr., Halifax.

Olds, Alta.
Tenders are to be called at once for the construction of a $3,500 school for the Public School Board. Secretary, J. Wells Johnson.

Ottawa, Ont.
Tenders are being received by the architect, J. A. Pearson & J. O. Marchand, Centre Block, until noon, October 22nd, for steel sash, doors and partitions etc., for central heating plant, also tenders for wire and cable required in Parliament Bldgs. for Department of Public Works, Ottawa.

Ste. Agathe Des Moines, Que.
Tenders are being received by the secretary, G. F. MacLure, until noon, October 21st, for the construction of an extension to sanitarium for Laurentian Society Treatment & Control of Tuberculosis, 804 Bank of Toronto Bldg., Montreal.

St. John, N.B.
General Public Hospital contemplate the installation of a refrigeration plant costing $4,000. Superintendent, E. Lorraine Woods.

St. Lambert, Que.
Plans are drawn for high school for Protestant School Board. Secretary, J. R. Beatty, 69 Lorne Ave.

Sarnia, Ont.
By-law is to be submitted shortly for the construction of a $40,000 addition to school and equipment for the School Board. Chairman building committee, R. E. Le Suer.

CONTRACTS AWARDED

Hamilton, Ont.
Church costing $75,000 for Polish Church: Roofing, John E. Riddle & Son, Ferguson Ave. N.; painting, A. McKay, 111 Charles St.

Mount Dennis, Ont.
The following contracts have been awarded in connection with the erection of a $40,000 school for S. S. No. 28, York: Plastering, Taylor & Nesbitt, 18 Havelock St., Toronto; sheet metal and roofing, J. H. Kidd, 1177 Weston Rd.; heating and plumbing, R. Paterson, 907 Keele St., Toronto; painting, W. R. Johnston.

Nanton, Alta.
Excavating is finished for a $27,000, brick addition to school for School Board: Carpentry and general contractor, Bennett & White Construction Co., City Hall Corner, Calgary; ornamental iron work, Union Iron & Foundry Ltd., 14th & 12th Ave. E., Calgary; plastering, H. Ward, 115 Montreal Ave., Calgary.

St. Catharines, Ont.
Foundation is in for addition to upper school costing $5,000 for Ridley College: Steel, Hamilton Bridge Works Co. Ltd., Bay St. N., Hamilton; roofing, John Peart, King St.; artificial stone, Peerless Artificial Stone Ltd., Coxwell Ave., Toronto.

Sydney, N.S.
Church costing $40,000 for Union Bap-

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Why Doesn't the Power Controller Act?

CONSIDERING the dependance of the engineering and contracting interests on an ample supply of power and the critical situation, covering practically the whole of Ontario at the present time, no apology is necessary for making a brief mention of this subject in the Contract Record. It seems to us that the matter is one that should be placed in the hands of a practical engineer, and we are satisfied a solution would very likely be forthcoming, to a certain extent at least, within a very short period. There is no doubt that the situation is critical and that essential industries are being held up—and by essential industries we include such industries as the manufacturing of munitions as well as other subsidiary and scarcely less important operations.

There is just so much power available in Ontario and there is so much demand for it. If the supply is equal to the demand, there is only one adjustment to be made—rearrange the distribution. If the supply is not equal to the demand, the urgency of the case surely offers only one solution—produce more power in the quickest possible time.

It is said by the chairman of the Provincial Commission that there are certain private companies operating at less than capacity. This being so, and on the supposition that these companies are being operated on a business basis and by business men, they have power to dispose of. On the other hand, if the Provincial Hydro is short of power, they are in the market to purchase. What possible excuse is there for failure to bring this seller and purchaser together? Yet it appears that this has not been done. Has the Ontario Commission made a fair offer to the private companies for their power? Have the private companies refused to accept a fair offer for their power? Has the power controller, who, we understand, is all-powerful in the matter, taken any steps to arbitrate between these two parties? These are questions, it appears to us, to which engineers and contractors have a right to expect straightforward answers. Does it not appear on the surface that it is merely a question of barter that could be arranged in the matter of an hour's conference, just as the purchase and sale of any other commodity can be arranged?

If, on the other hand, there is no surplus power anywhere, and it is shown that all the power available is being utilized at the present time, would it not be the part of wisdom to install plants other than the water power plants which at present are under way but which of necessity take a long time to complete? There can be little doubt that steam-operated plants could have been installed, within certain limits of capacity, that would have been of the greatest value of the present time. Perhaps it would have been a fairly expensive proposition. But what has that to do with the question when we are at war?

Of course, there are many minor details that may be arranged to ease the present situation, such as, for example, the distribution of available power on a priority basis, but this does not get at the root of the matter. What the province needs is a man who has sufficient ability and technical knowledge to grasp the situation and sufficient backbone to act.

After-the-War Export Trade

INDISCRIMINATE criticism of our government in these war times is to be deplored, but there are some deficiencies in its administration which cannot be overlooked. The indications are that peace cannot be delayed so very long, and we should be preparing for it, but the government is still showing an apparent lack of aggressiveness in taking up the problem of after the war trade. It is essential for the stabilization of our industrial life during the reconstruction period that we secure a fair share of the export trade which the work of restoring the devastated areas will stimulate. If we are not ready, our wide-awake competitors on the other side of the line will get in ahead of us, and we shall be a back number so far as the European market is concerned, for years. The coming of peace is our opportunity for entering upon that market, and our failure to take advantage of it will seriously handicap our industries.

Furthermore, Canadian engineers and contractors should be organized and ready to assist in the restoration work in France, Belgium and the other parts of Europe which have suffered, and may yet suffer, from the ravages of war. In a recent speech Sir John Willison stated that contracts had already been let in the United States to the extent of five billion dollars for reconstruction work in these areas. How does Canada stand as regards this big undertaking? If there is a possibility of our taking part in it, if our assistance is required, are we ready with the men, the materials and the organization? It seems not.

We have a Department of Trade and Commerce. That department should already have created the necessary organization through which our manufacturers, our construction concerns and our industries in general, may participate in the export and overseas business which will be open to us if we are ready. Our industrial concerns must also be prepared to cooperate. Has anything tangible been accomplished or arranged? The competition will be keen, and if we do not take action, and that speedily, the men who have been risking their lives in France for $1.10 a day, will return to find business depressed and wages low. They will return to find the country entangled in the unemployment problem and altogether unprepared to receive them.

A State Housing Scheme

THE State of Massachusetts has amended its constitution to permit of its undertaking the work of house construction. The first experimental houses, built at Lowell, have just been completed. The Homestead Commission has been taking up this problem, and in its fourth annual report stated the case as follows: "There are not enough wholesome, low-cost dwellings. There is no prospect that present methods will ever supply enough unless the State encourages their construction. Therefore, the State should experiment to learn whether it is possible to build wholesome dwellings within the means of low-paid workers." From experiments carried out by the Commission, several facts have been developed. First, it is declared that under the present market conditions a permanent well-built house, with accommodations, for a family of six or eight, can be built for from $1,800 to $2,400. Second: The price of a single house is very little more than the price of one of a group. Third: There is a lively demand for houses of this kind and character. Fourth: Good land is available within easy reach of our manufactories at prices ranging from $25 to $100 for a lot of about 5,000 square feet.

As regards the type of construction, the Commission, after considering every known method, decided on the following as the most suitable and economical and built their houses accordingly: Cellars—complete, concrete floor; outside walls—frame, boards, paper and stained cedar shingles outside; wood lath and plaster inside; windows—stock, double hung, 12 light; doors—stock, generally fir, galvanized butts painted and rim lock sets; floors—hard pine, oiled; ouside finish—Cypress painted white; inside finish—hard pine, stained and oiled; walls in kitchen and bathroom painted, elsewhere papered at average of 15 cents per roll; roof—Boards, paper and slate, surfaced asphalt twin shingles; plumbing—galvanized iron hot-water boiler, slate sink, cement set tub, enameled iron bathtub and lavatory, wash-down closet, sill cock, refrigerator, drain gas for range; wiring—porcelain knob and tube, spun brass fixtures throughout.

The houses will be sold on an easy-payment plan covering a maximum of 28 years, and the price will be such as to return a slight profit to the State. All overhead expenses are included in costs.

The commission has outlined two other types of development, besides this "urban" community. One is the suburban with houses all detached and occupying lots of one-eighth to one-half acre. The locality will be within a 5-cent fare of the mills. The houses will be similar in character to the urban houses, but some may be bungalows and the sidewalks, paths, fences, etc., will be different.

The third kind of housing is "rural." The commission plans to have lots varying from one-half to five acres, situated within a five-cent ride of the mills or a 6 or 7 cent ride. These houses will be farm houses, and will be studied to meet the demands of the family occupied in the middle of the day with millwork, but having a ploughed field, a cow and hens and other similar farm interests in the odd hours. With these three types the field of low cost housing will be fairly well covered.

Montreal Construction Increasing

THE building situation in Montreal has improved. During the first half of the year it looked as if 1918 would be even worse than the previous twelve months, which showed a decrease in building permits of nearly a million dollars, but in August business commenced to pick up, and previous declines have now been wiped out. Up to the end of September the total was $3,988,263, an increase over the corresponding period of 1917 of $187,598. Munition plants have contributed to this total, while industrial establishments have also been a factor in the improvement.

A fair amount of work has been secured outside the city; for instance, the huge plant of the American Products Co. at Shawinigan Falls was built by Church, Ross and Co.; Anglin's, Limited, have done a large amount of work on shipbuilding yards at Three Rivers; the Laurin & Leitch Engineering and Construction Company have carried out a contract for a filtration plant at St. Johns; Arsenault & Plamondon, Ltd., work on filtration plants at Pointe Claire, St. Hyacinthe, Ste. Anne de Bellevue, and a reservoir at Three Rivers; E. G. M. Cape, Limited, a military hospital at Ste. Anne de Bellevue, and Mr. G. Bastian, a filtration plant at Lachine. Fraser, Brace & Co. have secured a very important contract for building a dam near Sudbury for the International Nickle Co., and work on a filtration plant at Hawkesbury, Ont., is being carried out by Archambault & Leclaire.. An extensive contract for a sulphite mill at Kipawa, Ont., is also being carried out by the Geo. A. Fuller Co., Ltd.

The Crane Co., of Chicago, are building a very large factory on the banks of the Lachine Canal, the general contract being held by Anglins's Ltd.; extensive waterworks are being constructed at Montreal, and several churches and schools are in course of erection. The most important projects in sight are a Hydro-electric development at Back River; another munitions plant for the Canada Cement Co., and a large factory for the Canadian Consolidated Rubber Co.

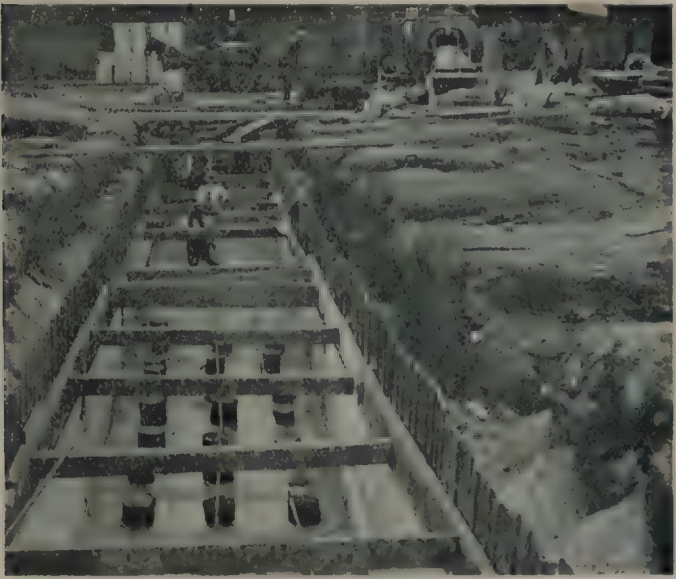
Builders' Conference Postponed.

In consequence of the influenza epidemic, it has been decided to postpone the proposed conference in Ottawa for the purpose of discussing the formation of a Dominion Builders' Exchange, as well as various questions of interest to builders, contractors and supply men. The subjects proposed cover a very wide range, the object generally being to further the interests of the industries. It has now been arranged to hold the conference on Nov. 26-27-28.

New Office Building of Toronto Harbor Commission on Water Front

THE Toronto Harbor Commission's new office building, which is illustrated in the accompanying cuts, has recently been completed, and architecturally it forms an attractive addition to the business buildings of Toronto. It stands close to the waterfront, just west of Bay street, on the north side of what will eventually, when the Commission's reclamation programme is finished, be an 86-foot marginal way, to be known as the Queen's Quay, with an additional area having a depth of 140 feet on the south side, which property will be used for warehouse sites and light manufacturing buildings, being served by steam and radial electric railways.

The building is 100 ft. x 65 ft. in plan, and five storeys and basement high, which practically amounts to six storeys, as the floor of the basement is only 3 ft. below the grade of the street and excellent lighting is provided. In the basement are the boilers, fuel storage, janitor's quarters, blueprinting and photographic department, vaults, etc. The first two floors are taken up by the Commission's offices, the cost-keeping, construction and comptroller's departments being on the first floor, and on the second floor, the board room, offices of the general manager and chief engineer, and various officials, and industrial and surveys and lands departments. The designing department occupies part of the sixth floor and the balance of the building has practically all been rented to other concerns. Among the tenants are a number of construction firms. A feature which will appeal to many tenants is the restaurant which is fitted out on the sixth floor. There are two elevators and an ornamental iron stairway connecting all floors.

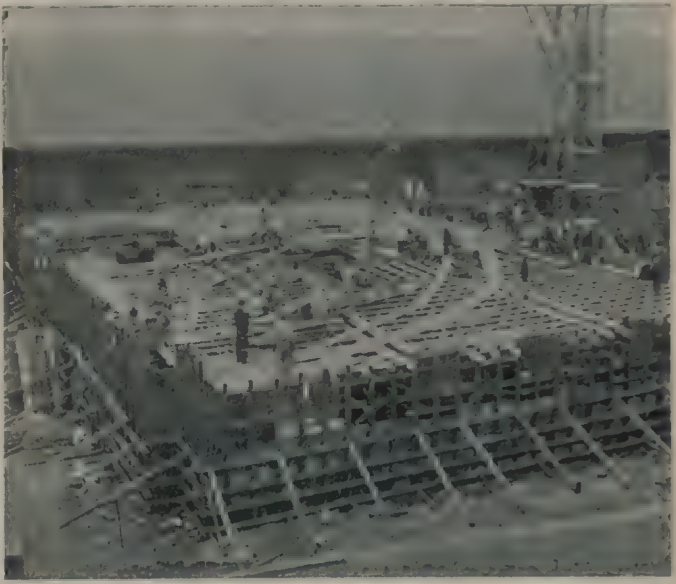


Running Concrete Footings

In the basement a hydrograph is installed for measuring the level of the lake. This is operated by a float which gives a continuous automatic record of the fluctuations of the water levels of the lake.

On the water front, opposite the building, a landing stage has been constructed for the accommodation of the public, where small craft can come in and pick up or land passengers.

The building is of reinforced concrete construction, on spread footings, these footings being carried on round bearing piles which are driven to rock. Fig 1 shows the foundation work under way. It will be noted that steel sheet piling was used as form work for the concrete footings. The tops of the concrete piles, over which the concrete was poured, are also seen in this illustration.



Pouring Concrete up to First Floor

Truscon Floortyle was used in the construction of the floors, thus producing a shallow slab carried on deep, narrow joists. Flat ceilings were obtained by the employment of Hy-Rib, to which the plaster was directly applied. The columns, which are placed at 16 ft. 8 in., centres longitudinally, and 11 ft. 6 in. centres laterally, are of the usual type with steel bar reinforcing and hooping. In Fig. 2 work is shown in progress on the first floor.

There were no unusual methods used in the construction. At the commencement, barrows were employed in the placing of the concrete, but these were early discarded for buggies, owing to the careless handling of the laborers, who, frequently, in dumping the concrete, allowed the barrows to slide off the platform and displace the reinforcing. This trouble was eliminated by the use of the buggies. The concrete was delivered to the buggies from the hopper (shown in Fig. 2), into which the concrete was dumped by the hoisting bucket.

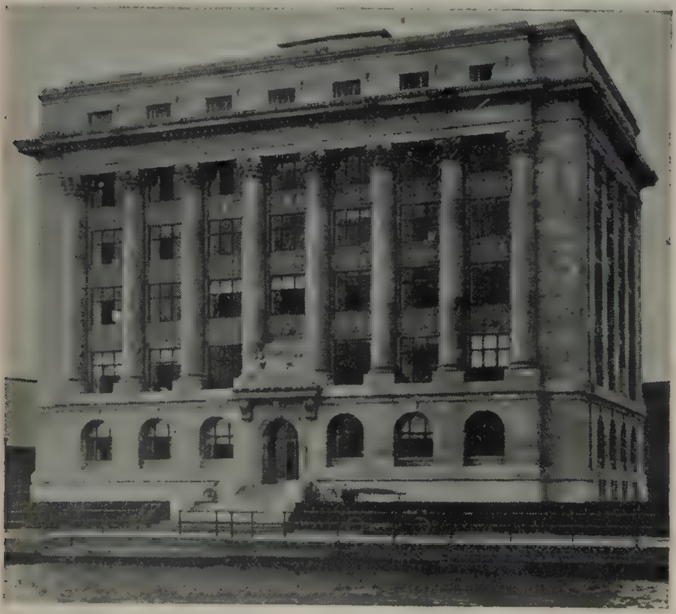
The concrete sill resting upon the piles, the concrete floors and the exterior concrete walls were waterproofed with two coats of Antiaqua, supplied by the Dominion Paint Works, Ltd., Walkerville, Ont.

Denison interlocking hollow tile was used for all vault walls, the walls and furring and solid partition work in the basement, the walls enclosing stairs and elevators, and the spandrel walls of all windows.

Gypsum block, supplied by Ontario Gypsum Co., of Paris, Ont., was used for furring the exterior walls above the basement with the exception of the tile spandrels between windows, and also for the construction of partitions.

Wall Forms on Upper Floors

As will be seen in the illustration, the fine appearance of the building is largely due to the excellence of the stone work. Buff Indiana limestone, of the type known as "Bedford Stone," was used for the most part. The lower course, however, as well as the entrance steps and parapets to same, is of Queenston limestone, while the ornamental panels between the windows, and the window casings, sills and jams, are of artificial stone. The exposed surface of the Bedford stone is rubbed, and the Queenston limestone is fine bush hammered. The stone pillars with which the building is faced and the carved figures over the doorway add particularly to the architectural attractiveness. The usual precautions were taken to prevent the staining of the stone from contact with concrete or mortar, an inch air space being maintained as far as possible and bituminous coatings also being employed.



View from the Water Front

The building is doubly protected from fire by the nature of its construction and the provision of a sprinkler system.

The contract for the erection of the building was carried out by Messrs. Archibald & Holmes, Ltd., of Toronto, the foundation work, however, being executed by the staff of the Harbor Commission. The work on the superstructure was commenced in July, 1917, and the concrete construction was completed by October. The stone work proceeded through the winter and the building was ready for occupation by the first of June, this year.

The architect for the building was Mr. Alfred Chapman, who now occupies offices in it.

Sub-contractors and suppliers of material were as follows: Roofing and sheet metal, D. M. Rowe, 30 Atkin Ave.; plastering, R. C. Dancy, 153 Spadina Rd.; iron stairs, ornamental metal doors, Canadian Ornamental Iron Co., Ltd., Toronto; metal sash and glazing, Trussed Concrete Steel Co., Toronto; marble work, Hoidge Marble Co., Toronto; elevators, Otis-Fensom Elevator Co., Toronto; electric wiring, E. F. W. Salisbury, Toronto; sprinkler system, W. J. McGuire, Ltd., Toronto; vault doors, J. J. Taylor, Toronto; hollow tile, National Fireproofing Co., and Sun Brick Co.; cement, Canada Cement Co.; stone (aggregate), sand and gravel, Rogers Supply Co.; cut stone work, Page & Co., Toronto; artificial stone, Peerless Artificial Stone Co., Toronto.

Woman As Highway Superintendent

MANY occupations that before the war were considered suitable only for men, have been taken over by women. But County Engineer David White, of Tacoma, Wash., believes that Pierce County is the first to have a young woman superintendent for a concrete highway contract. The Pacific Highway from Tacoma to Camp Lewis is the job, and Miss Verona M. Morgan, the 19-year-old daughter of Contractor T. M. Morgan, of Everett, Wash., is the young woman. Miss Morgan acted as superintendent last year on Snohomish County Bond Issue Road No. 28, leading from Monroe to the King county line—a job six miles in length. She has handled this work most efficiently and this is one of the first jobs at the low prices prevailing then upon which a profit was made.

Miss Morgan is supervising all details of "hiring and firing" the labor, keeps the books, and is a real general manager. In addition to these duties, when the camp cook recently exercised the cook's prerogative and quit without notice, the young lady kept the job going by doing the cooking for forty men for three days until a new chef could be secured. Mr. Morgan has several concrete highway contracts under way this season and wishes that he had more daughters.

According to Mr. J. P. Dupuis, president of J. P. Dupuis, Ltd., Verdun, P.Q., manufacturers of interior trim, the demand for standard sashes and doors is increasing. This is partly due to the fact that many houses which were partly built when war broke out, and on which work was stopped, are being completed. The demand from the country districts, added Mr. Dupuis, is good, owing to the satisfactory condition of general business in the province.

Tests to Determine the Rigidity of Riveted Joints in Steel Structures

A SERIES of tests to determine the rigidity of riveted joints connecting members of steel frame structure were made recently under the general supervision of Dr. F. H. Newell, head of the Department of Civil Engineering of the University of Illinois.

Six test pieces, listed in Table I, were used. They were tested in pairs in a 300,000 pound Olean four-screen testing machine under conditions that would maintain in actual practice. The strain measurements included the slip of rivets and the deformation of the angles used in making the joints.

Definition of Slip

In figuring stresses in riveted connections, it is necessary to assume that the connections are prefectly rigid. It is also customary, in analyzing the stresses in a stiff structure to consider that where a column and girder intersect, both members maintain a constant cross-section up to the point of intersection of the elastic curves of the members, except for members having a width of zero.

In determining the slip in the connections from the tests, the computed rotation of a point in the girder relative to a point in the column, due to the strain in the material, was subtracted from the measured rotation of one point relative to the other. In computing the relative rotation of the two points due to the strain of the material, both members were considered as having constant cross-sections up to the point where the elastic curves of the two members intersect; thus what is really obtained in the analysis is not the error due to slip alone, but rather the combined error resulting from two assumptions, one that the connection is perfectly rigid and the other that both members maintain a constant cross-section up to the point of intersection of the two elastic curves.

Table I—Properties of Columns and Girders

Test Piece	Column		Girder		For Frame 15 Feet High and 20 Feet Wide. $K=\frac{I}{l}$ for Girder, $nK=\frac{I}{l}$ for Column		
	Section	I for Gross Section	Section	I for Gross Section	nK (for col.)	K (for girder)	n
A1	1 – Pl – 14x⅜ 4 – Ls 5x3x⅜	584	1 – Pl – 24x⅜ 4 – Ls 5x3x⅜	1966	3.25	8.20	.4
A2	Same as A1	584	Same as A1	1966	3.25	8.20	.4
A3	12″ – I – 31.5	215.8	12 – I – 31.5	215.8	1.20	.90	1.33
A4	12″ Flat – I – 31.5	9.5	12 – I – 31.5	215.8	.05	.90	.055
A5	Same as A1	584	Same as A1	1966	3.25	8.20	.4
A6	8″ – H – 39	130.5	12 – I – 31.5	215.8	.78	.90	[illegible]

The Effect of the Slip in Connections Upon a Rectangular Frame

In a rectangular frame subjected to a shear parallel with one side of the frame, if the connections at the corners of the frame are frictionless hinges, the frame will collapse. If, however, the connections at the corners are capable of resisting moment, the frame will remain substantially a rectangle, but possibly deformed. The rigid connections between the vertical and horizontal members hold the ends of the vertical members in a nearly vertical position and thus prevent the frame from collapsing.

In order to determine the magnitude of the change in the deflection and in the distribution of the stresses in a rectangular frame due to slip in the connections, the standard formulas are used.

Strength of Test Pieces

In computing the allowable working loads upon the test pieces the following unit stresses were used:

Axial bending stress	16,000 lbs. per sq. in.
Shear on rivets	12,000 lbs. per sq. in.
Bearing on rivets	24,000 lbs. per sq. in.

The computed working loads are given in column 3 of Table 2. Methods of computing the working loads on connections of the types used in the test pieces have not been standardized. The methods used in computing working loads given in Table 2 are as follows:

Table II—Loads on Test Pieces

Test Piece	Load at Failure on One Girder Lb.	Working Load Lb.[1]	1.5 Times Working Load Lb.[2]	Load at Failure Divided by Working Load	Moment on Connection at Failure In. Lb.	Manner of Failure
(1)	(2)	(3)	(4)	(5)	(6)	(7)
A1	44,450	17,500	26,250	2.54	5,334,000	Column buckled
A2	37,500	18,540	27,800	2.02	4,500,000	Gusset plate buckled
A3	10,250	3,030	4,545	3.38	537,000	Lug angle opened
A4	13,550	5,000	7,500	2.71	570,000	Column buckled and angle opened
A5	18,700	3,400	5,100	5.50	1,860,000	Connection angle opened. Rivet failed in tension
A6	11,250	2,750	4,125	4.10	506,000	Connection angles opened

[1] Based upon the following unit stresses:
Axial bending stress, 16,000 lb. per sq. in.
Shear on rivets, 12,000 " " " "
Bearing, Rivets, 24,000 " " " "
[2] Corresponding to allowable working stresses for wind loads.

A1.—The strength of the connection of test piece A1 to resist moment is considered to be the moment of a couple composed of two horizontal forces, one force is applied at the centroid of each flange; the magnitude of each force is the working strength in bearing of the eleven rivets connecting each flange of the girder to the gusset plate. The working load on the girder is the load which applied at the outer end of the girder produces the given moment on a vertical section through the outer row of rivets in the gusset plate. The vertical shear is considered to be taken by the vertical splice plates connecting the girder web to the gusset plate.

A2.—The working load for test piece A2 was determined in the same manner as for test piece A1.

A3.—The strength of the connection of test piece A3 to resist moment is considered to be the moment of a couple composed of two horizontal forces; one force is applied at the top surface of the girder and the other at the bottom surface of the girder. The magnitude of each force is the working strength in shear of the two rivets connecting the lug angle to the girder. The working load on the girder is the load which applied at the outer end of the girder produces the given moment on a vertical section through the rivets connecting the lug angles to the girder.

A4.—The strength of the connection of test piece A4 to resist moment is determined by the same method as for test piece A3. The working load on the girder is the load which applied at the outer end of the girder produces the given moment on a vertical section through the middle rivet connecting the lug angle to the girder.

A5.—If the strength of the connection of test piece A5 to resist moment is regarded as determined by the strength to resist moment of the rivets attaching the connection angles to the girder, if the outer rivet at each end of the connection angles is considered to be in double shear, if the strength of the intermediate rivets is considered as determined by bearing on the web plate of the girder, reduced one-third for the loose fill, and if the stress in the rivets varies as the distance from the center of gravity of all the rivets, the working load on the girder is the load which applied at the outer end of the girder produces the given moment on a vertical section through the rivets attaching the connection angles to the girder. The vertical stress upon the rivets is neglected.

A6.—Consider the strength of the connection of test piece A6 to resist moment to be determined by the strength of the rivets attaching the connection angles to the girder web, consider the stress on each rivet due to moment to vary as the distance from that rivet to the center of gravity of all the rivets, and consider the vertical shear to be evenly distributed over all the rivets. The working load upon the girder is the load which applied at the outer end of the girder produces on a vertical section through the center of gravity of the rivets attaching the connection angles to the girder web a moment equal to the resisting moments of the rivets.

The unit stresses which have been used in determining the working loads on the girders as given in Column 3 of Table 2 are the usual allowable working stresses due to dead and to live loads. This type of connections for the test pieces is used largely for building frames in which the bending stresses are due to wind loads. When wind load stresses are combined with dead and live load stresses, the allowable working stresses are usually fifty per cent. greater than the allowable working stresses for dead and live loads alone. In discussing the results of the tests, loads one and one-half times the working loads for dead and live loads alone, corresponding to wind load working stresses, are used. These loads are given in column 4 of Table 2.

Table III

Effect of Slip in Connections upon Moments in Rectangular Frames

Test Piece	Errors Due to Slip	P x h in lbs.	1.5 Times Working Load
A1	9%	12,600,000	26,250
A2	7%	13,300,000	27,800
A3	138%	910,000	4,545
A4	50%	1,290,000	7,500
A5	104%	2,000,000	5,100
A6	435%	742,000	4,125

Conclusions.—The main object of these tests was to determine whether serious error is introduced into computations for stresses in steel frames by the assumption that the joints are perfectly rigid.

The rigidity of various types of joints has been studied by means of tests, and the error introduced into computations studied by means of mathematical analysis of the action of frames with slip at the joints of a magnitude such as was observed in these tests. The action under a load producing stresses equal to one and one-half times the working stress has been taken as a criterion, and for the joints studied the following conclusions reached:

Connections of the type used for specimens A1 and A2 are so rigid that for the purpose of analyzing stresses in rectangular frames the connections can be considered as perfectly rigid without introducing serious errors into the results.

The error due to slip in the connection is less for A2 than for A1.

Connections of the type used for specimens A3. A4, A5, and A6 for the purpose of analyzing stresses cannot be considered perfectly rigid.

Table 3 is a tabulation of the result of the various tests, showing the errors due to slip in riveted connections under ordinary working conditions.

Further Proposed Power Development

MR. Henry Holgate, consulting engineer, Montreal, has drawn preliminary plans for a Hydro-electric development on the Riviere des Prairies, Montreal. Senator M. J. O'-Brien, of Renfrew, is at the head of the company promoting the project, Messrs. Quinlan & Robertson, contractors, Montreal, being interested in the scheme. The proposal is to construct a dam in the form of an arc at a point above the Sacred Heart Convent, on the Montreal side, almost to the other side of the river, and from there in a straight line to Sergeant's Island, and to the northern shore of Visitation Island, continuing along that shore to a point below a small island known as Cheval de Terre Island. The power station will be on the south side of Jesus Island, the preliminary plans making provision for 9 units. It is estimated that the plant will develop 40,000 h.p. The erection of the dam will raise the level of the river by about 15 feet, and will interfere with several sewer outlets from the city of Montreal. It will also result, it is stated, in the flooding of a large area of land adjoining the river. The civic authorities objected to the scheme on the ground of its interference with the sewer outlets, necessitating a considerable amount of reconstruction. The promoters and a deputation from the city of Montreal, including Mr. Paul Mercier, the chief engineer, met the Quebec Cabinet, it being necessary to secure the consent of the Quebec Government to the use of the bed of the river. Federal sanction has already been obtained, subject to certain modifications of the original scheme. Sir Lomer Gouin suggested that the promoters meet the city of Montreal, and see if an arrangement could be made for carrying out work which will meet the objections of the city and other municipalities and also for bearing the cost, the representatives of the company being apparently willing to undertake some financial obligations. The Premier added that when an agreement had been reached, the interested parties could again see the Cabinet, with a view to obtaining the requisite authorization.

A proposal has been made to enlarge the scope of the Vancouver and district Joint Sewerage Board so as to take in New Westminster. The object of this amalgamation is the elimination of the maintenance of separate plants and separate operating staffs, it being held that a large saving and more systematic work could be effected in this way.

New Soap Factory at Perth, Ont.

THE large soap factory being built by the Andrew Jergens Co., of Cincinnati, Ohio, and Perth, Ont., in the town of Perth, is now almost completed. The plant consists of a factory building and a building for the power plant, oil refining plant and glycerine evaporator.

The main building is a four-storey structure of fire-resisting mill construction, 158 ft. long x 68 ft. wide. The foundation, which is of concrete, rests on a 4-foot concrete footing carried down below the frost line, and extending up to the floor level. The superstructure is of white brick laid in cement mortar. The building is of pier construction, the heavy pilasters being of average width of 3 ft. They extend from the bottom of the foundation to the roof cornice, and between each pair of pilasters, and filling the whole space, are wooden sash windows of a mean width of 4 ft. 2 in., so that for all intents and purposes the building consists of pilasters and windows only, the only bits of brick wall proper being brick spandrels or curtain walls above and below the windows.

Practically no structural steel was used in the construction, heavy British Columbia fir taking its place. Beams, 8 in. x 12 in., were placed at 7-foot centres, carried on 12 in. x 12 in. and 12 in. x 14 in. girders, which in turn rest on cast iron post caps of the 12 in. x 12 in. or 10 in. x 10 in. columns.

The first floor is of concrete, and is placed at an elevation of about 3 ft. above grade. The other floors are of spruce, 4 in. thick (slip-tongue joints) on top of which is a 7/8 in. maple floor, insulating paper being used between the two.

The roof is of somewhat unique construction. It is hipped from the centre to the two sides with the gutters running to the four corners to inside down pipes. The down pipe hoppers are protected with the usual copper rat trap screens.

Two fireproof stair towers and one elevator tower extend through each floor.

Large Steel Tanks Installed.

In this building are installed a large number of heavy steel tanks, two in particular being noteworthy as extending from a foundation beneath the first floor up through the third floor, or 35 ft. in all. This, of course, includes a pilaster of steel, the tanks proper being 25 ft. high by 10 ft. in diameter. These are boiling tanks and have a capacity of 15,000 lbs. each. Another tank of unusual dimensions is rectangular in shape (all the others are round), being 45 ft. x 12 ft. x 8 ft. This is said to be the largest tank of its kind in Canada.

A word as to the uses to which the various floors will be put—the offices, shipping room and stock room, will be on the first floor, cold process and mill soaps and wrapping department on the second floor, perfumes and toilet articles on the third, and talcum and face powders, etc., on the fourth floor.

Another building in connection with the factory is what is known as the combination building. It houses boiler and engines, glycerine evaporator and apparatus for refining oils. This building, which is 81 ft. x 88 ft., two storeys high, is of the same type of construction as the main building, with the exception of the roof which is of reinforced concrete, supported by large steel trusses. A radial brick stack, 150 ft. high, is erected through the centre of this building.

Power in the factory will be supplied throughout by means of individual motors, the steam plant taking care of the heating and supplying live steam for the boiling processes.

Work on the construction of this factory was begun late in August, 1917. Before any excavating was done soil tests were made and nature of the ground determined by boring with a diamond drill. There being no basement, a trench 5 ft. wide was dug, and the concrete footing placed in this. Two one-third yard mixers, one driven by steam and the other by gasoline engine, were used to mix the concrete.

No floors were laid until all brickwork was finished, so a tremendous amount of scaffolding was made necessary. Brick, mortar, etc., were hoisted by means of a two-cage elevator operated by horse-power, while to raise timber, frames, etc., one setter and one circle swing derrick proved invaluable.

As winter approached, considerable bad weather was encountered, so in order to make use of all fine days, powerful nitrogen lamps were installed and for a considerable time work was continued from 7 a.m. to 10 p.m. with an hour off for dinner and supper. The lights were so arranged as to be easily shifted, and were each day placed so as to be in the best position for the night's work.

Brick Laid During Winter.

Brick was laid all through the winter except on the very coldest and stormiest days, although considerable difficulty was experienced in keeping the cement mortar from freezing. However, hot sand, hot water and frequent tempering of the mortar overcame this difficulty.

View of factory and power house.

All heavy timber was in a field a short distance from the factory and as a siding connected the two, the timber was easily carried on railroad lorries.

All scaffolding for the smoke stack above the roof was on the inside, pieces of 4 x 4 being built into the brick at convenient distances apart, and the floor was carried up on these. A round hole was left through which material was hauled up. An iron ladder was built into the brick and to haul up brick, etc., a T-shaped hardwood mast with a pulley at each end of the horizontal part was simply stuck into the last two or three rungs. A rope ran over the two pulleys, one end going through the hole in the floor to the buckets below, the other being outside the stack and connected with a large wooden cupsale driven or turned by a horse. This method of raising material proved very satisfactory.

Plans and specifications were prepared by Simon Cooper, architect, of Connecticut, Ohio, while W. J. Rabb, general contractor, Perth, Ont., had full charge of the construction.

Rapid Building of Timber Coffer Dam

In the construction of the Government lock and dam at Troy, N.Y., it was necessary to finish the west one-half of the concrete dam during one working season. In order to expedite this work a special method was selected for the rapid building of the frame work of the 1,000 ft. long wooden coflerdam, which is described in Engineering and Contracting. This frame work consisted of two horizontal and parallel sets of timber spaced about 20 feet apart and tied across with iron rods and struts. The frame resembled two parallel board fences with a distance between the fence posts of about 21 ft. In building two corresponding sets of timbers were placed on a pair of cradles laid flat on a barge. The two cradles were then raised, the tie-rods were put in, and the timbers bolted to the portion just completed. The new section was then picked up by derrick boats and slid part way over the side of the barge until there was room enough to lay down another set of timbers on the cradles, which were again raised up when ready and connection made with the preceding section. Later these frames were lined with sheet piles and the dam filled with sand and gravel. By this method it was found that the timber work could be built very rapidly, the greatest speed attained being 100 feet in two 8-hour shifts.

Carrying Capacity of Various Types of Piles

The carrying capacity of the various types of piles in general use will furnish material for a very interesting comparison, using a standard formula, uniform length and similar soil conditions in each case.

Under Patton's well-known formula, the tables on frictional adhesion and direct bearing power show that under average conditions a pile would develop 300 lbs. of frictional resistance per square foot of surface in contact with the soil penetrated, and 5 tons direct bearing power per square foot of base area resting on the subsoil.

Mr. Henry W. Young, in Engineering and Cement World, has figured that a wooden pile 30 ft. long, 12 in. in diameter at its butt and 7 inches diameter at its point or base, would have a frictional surface of 74.5 sq. ft., and as each square foot of surface would provide 300 lbs. of carrying capacity, the total frictional resistance will be 11.2 tons. Similarly, a pile of 16 ins. in diameter at its head, 16 ins. diameter at the base, and 30 ft. long will develop frictional resistance of 18.8 tons. These figures, as well as figures for the other sized piles, are tabulated below.

With a unit bearing value of 5 tons per square foot, the wooden pile having a base area of .270 sq. ft. would carry a direct column load, due to the pressure of its base upon the subsoil, of 1.35 tons. Similarly, the point of a straight pile 16 ins. in diameter would transmit a direct column load of 6.96 tons to the subsoil. Adding these values to the loading obtained by friction we get the total load carried by a wooden pile as 12.6 tons and by the large straight concrete pile as 25.8 tons.

The frictional carrying capacity obtained with a pedestal pile of the MacArthur type will amount to as much, if not more, than that provided by a 16-inch diameter straight pile. As was already seen, this frictional carrying capacity is 18.8 tons on a pile 30 feet long.

Owing to the broad base of the pedestal pile, the load supported by direct bearing under the base is usually greater than that supported by friction on the sides. The projected area of the base, corresponding to a diameter of 3 ft., is 7.1 sq. ft. With subsoil capable of carrying a direct load of 5 tons per square foot, the total direct load carried by the foot of the pedestal pile would be 35.5 tons. This, added to the carrying capacity developed by friction, makes the total carrying capacity of the pile 54.3 tons.

Carrying Capacity of Various Types of Piles for Average Soil Conditions

(Based on Patton's Formula)

Size of pile	Surface area, square feet.	Frictional carrying capacity at 300 lbs. per sq. ft., tons.	Bearing area at foot or point square feet.	Direct bearing capacity at 5 tons per sq. ft. tons.	Total carrying capacity of pile, tons.
Wooden pile 30 ft. long, diameters 12" and 7" ...	74.5	11.2	.270	1.35	12.6
Concrete pile 30 ft. long, diameters 18" and 6" ...	94.3	14.2	.205	1.03	15.2
Concrete pile 30 ft. long, diameters 14" and 14" ...	110.0	16.5	1.07	5.35	21.9
Concrete pile 30 ft. long, diameters 16" and 16" ...	125.7	18.8	1.395	6.96	25.8
Pedestal pile 30 ft. long, diameters 16" and 36" ...	125.7	18.8	7.10	35.5	54.3

Reinforcing the Pedestal Pile

It is seldom found necessary to place reinforcing rods in the stem of the pedestal pile. The stem, surrounded by soil throughout its entire length, receives great lateral stiffness therefrom, even in soft soils, and cannot be considered in the same class with a column standing free in air. The function performed by vertical steel rods in a reinforced concrete column is not so much to increase the total compressive strength of the column section as to take care of tensile strains set up by column flexture. The strains due to column flexture in the stem of the pedestal pile are practically nil, owing to the bracing action of the surrounding soil, and therefore rod reinforcement is, in most cases, unnecessary as well as expensive. Actual tests have shown that large loads can be carried, even on long piles through soft soil, without the need of rod reinforcement in the stem of the pile.

Occasionally conditions arise where the pile receives some lateral thrust. as well as its vertical compressive load. The horizontal thrust at the base of a retaining wall is one example of this condition. Under such conditions the pile may be called upon to resist a certain amount of flexure, and rod reinforcement is consequently desirable.

The military authorities have asked permission from the Toronto board of control to close Ridge Drive in order that they may erect 24 temporary buildings for military purposes during the war and later for demobilization. Mr. Thomas Hastings represents the Dominion Government in the matter.

The Road: Its Paramount Importance

By the Right Hon. Sir J. H. A. MacDonald, K.C.B., L.L.D.

What we want, my Lords, is Roads, Roads, Roads.
—Duke of Wellington.

THE nations of Europe are now, to the number of seven, engaged in a war such as has never been seen in the history of the world. The number of the troops engaged and the extent of front occupied by the contending forces exceed anything that has been witnessed in ancient or modern days. For the first time war-transient by road is being conducted to a very great degree by mechanical power, and such power is being used not only for conveyance of stores, but also for moving artillery and machine-guns, serving Generals and their staffs by carrying them rapidly throughout the extent of their command, conveying orders and despatches, and making rapid reconnoitring attacks by armoured vehicles, in all of which services great speed can be used without failure or serious limitation of endurance, such as necessarily attaches to a service in which no other accessory power is available except that of animals. This war will, therefore, teach many lessons on the subject of the road. For warfare on any extended scale, roads are essential, and more so than ever in the twentieth century. Upon the sufficiency of the roads, and their ability to withstand the attack of heavy traffic without becoming unfit for efficient use, the success of a campaign may in great measure depend. We know how nearly the bad state of the roads jeopardized the arrival of Blucher in time to clinch matters at Waterloo, the whole of a long day being necessary for an eleven miles' march. It is told of the great Duke of Wellington, when a debate took place on the first Kafir war in Africa, that he summed up what was necessary, in addition to well-trained and well-armed troops, by saying: "What we want, my Lords, is Roads, roads, roads!" To his mind, roads were essential to the conduct of war, so that the troops and their arms might be used to the best advantage. More than ever today, when power vehicles will be employed in all but cavalry work, it is indispensably necessary that national attention should be freely given to the road problem, so that our country should not be put to disadvantage, if war comes within its borders, because its roads are insufficient in number and deficient in quality.

Greater Service Demanded from the Highway.

It may now be laid down without risk of intelligent contradiction that if the country is to be well served by its roads, these must be capable of carrying a very different traffic, both in bulk and character, from that of the latter half of the last century, when the use of the road was comparatively trifling, because all distance locomotion by heavy vehicles had been diverted from the road to the railway. In consequence of this old roads deteriorated, and were repaired on the cheap, and new roads were flimsily constructed. It is now practically admitted on all hands that road construction and maintenance, neglected for half a century, are once more of paramount importance, and that it is a matter of public necessity that the roads shall be made fit to bear the traffic which passes over them, traffic which tends every day to increase in volume as regards all classes of vehicles, and in mileage as regards the distance per day which each vehicle accomplishes. The carriage which used to jog along for its fifteen or twenty miles is now replaced by the car, which can traverse three of four times that distance in the same time and be still fit for further work. The professional man who travelled daily by train to and from business now runs in and out in the same time, or even more quickly, by car or motor-cycle. The farmer who sent his crops, his fruit, and his vegetables over long distances to the market town can now have them conveyed direct from farm to market more quickly and in better condition and with less injury, than when loaded and unloaded many times, and knocked about in shunting from and to sidings. The vans of the town tradesman which went ten or twelve miles into the country daily to deliver goods now go twice or even three times that distance, out and in, each day. The road tourist thinks nothing of a journey of one hundred and fifty or two hundred miles in one day. All this development has taken place in little more than a decade, and that there will be a great increase of all classes of road traffic for some time nobody can doubt; while in war on land efficient roads will be a sine qua non, in view of the strain of heavy traffic of guns and munitions of war. War is no longer a leisurely conducted affair; Von Clausewitz's caustic saying that "standing still and doing nothing is quite plainly the normal condition of an army in the midst of war, acting the exception," is no longer a true reproach to those who conduct campaigns. Speed is the aim, and the measure of speed is the quality of the road.

The road being now of paramount national interest, a step was taken in furtherance of that interest when the Imperial Road Board was appointed a few years ago, to which was committed the proceeds of the petrol-tax and the auto-vehicle licenses, bringing in more than a million sterling at first, and the amount steadily increasing from year to year.

Everywhere throughout the land more power vehicles are being put upon the road in each season, and a corresponding diminution of animal drawn traffic is taking place. The extent to which this is so appears not to be fully appreciated by many. It is still quite common to hear motor traffic spoken of as something exceptional, and as an intrusion upon general traffic. The power vehicle is still looked upon by many of the public and by not a few local road authorities as an interloper, to which no consideration need be given except by way of complaint and objurgation. People who think so and speak so will have to awake, whether they like it or not, to the fact that motor traffic has in great degree become, and will in greater degree become, the traffic of the road, and that animal haulage must recede into the position of being the exception, and that a negligible exception, where formerly it was the rule. A few statistics will be found convincing by all but those who fall into the category of the man persuaded against his will, who is "of the same opinion still." The figures may be interesting. Observations recently made in London bring out most remarkable results. A test recently taken at the top of Haymarket, where the vehicles must pass in both directions through a driving-space of only forty-six feet in width, the time of the test being one hour, between 7.30 p.m. and 8.30 p.m., brought out the following result:

Passenger Vehicles.

Motor	Horse
1750	17

In country districts it is much the same. Five days' observation in Perthshire gave this result:

Motor	Horse
111	1

A test taken of cabs only, in Pall Mall, counting up to 600 of those mechanically driven, resulted thus:

Cabs.

Motor	Horse
600	4

Of the horsed cabs, two were four-wheelers and two were hansoms.

In the case of the commercial vehicle, the progress has not been so rapid. It was not to be expected that it would be in the same ratio. The merchant using animal haulage has to think twice and thrice before making the change. It is hazardous for him to experiment, as it is the rich only who use vehicles for convenience and pleasure that can do so without financial risk. The outlay in purchasing vehicles which represent both the horse and the wagon is necessarily great, and unless the trader is able to assure himself that he can have his work done more economically, more conveniently, and more rapidly, without increasing the percentage of cost of carriage, he naturally hesitates to make a change. There is a reasonable inclination, before making the plunge, to wait and see how the adventurous who first make the change come out of the venture. But while such considerations have been "canny" and prudent, it is becoming more manifest, month by month, that conviction has come to the commercial community that the adoption of power haulage is a prudent and wise step, consistent with economy, advantageous in time-saving, making extension of deliveries more easy, and in more ways than one bringing about an increase of business. No one who observes can fail to see that the number of power vehicles carrying goods has been rapidly increasing, and continues to increase day by day. Observations taken in London show that from one-third to one-half of the commercial vehicles upon the street, in the busy thoroughfares round Trafalgar Square, are now driven by mechanical power. Tests on recent occasions brought out:

Commercial Vehicles.

Horse	Motor
92	54
66	33
120	71
91	57
30	24
17	18
30	22
446	279

But perhaps it may be said that London is not a fair criterion for the country generally. Here is a test taken when driving to Woking:

Horse	Motor
89	48

It must be understood that the figures both of fast vehicles and commercial vehicles, vary up and down, and the statistics given may be held to be the most favorable to the power vehicle. But an average of tests brings out that, in the case of the fast vehicles, the percentage of animal-drawn traffic is certainly not more than two or at most three, and in the case of the commercial vehicles the power-driven are certainly not less than a third, and often are nearer one-half. Thus fast horse vehicles are now a neglible quantity, and the progress in the adoption of mechanical power in the case of the commercial vehicle makes it plain that it, too, will in a very short time be the dominant factor in the traffic. In the case of trade vehicles, the removal of horses for war service will cause many people to turn to power-traction; therefore it is the power vehicle that has to be considered, and must be considered, when the question is: How are the roads to be made fit for their purpose in such circumstances?

It is satisfactory to know that it is in this country that the greatest advance has been made in the ascertainment of the best mode of road construction and road maintenance. It is possible now in many places to drive for many miles in the driest weather without there being any raising of dust. This in itself is a thing of great advantage in the direction of comfort to the road user and roadside dweller, of prevention of deterioration of goods, and of maintenance of public health. But these, however satisfactory, may be called side-advantages only. If a road is dustless it is not only satisfactory in these respects, but its condition testifies in an unanswerable manner to the fact that it is not a road that materially deteriorates under traffic. Its dustlessness is a proof that the surface is not crumbling away, but remains practically intact and, therefore, impenetrable to water. Water is the most deadly enemy that the road has to encounter if once it can penetrate below the surface. While the roads which are exhibiting this efficiency were at the time of construction, to a certain extent experimental, the period during which they have stood the test of traffic —already equal to from two to four years in many cases—has enabled the road engineer to gain further experience and, by experiment, to work out improvement, so that it can now be said with confidence that the formula for a durable, dustless, and economical road surface has been attained.

In former days the destruction of roads was caused by the penetration of water into the roadcrust in wet weather, and, in the case of very dry weather following, by the failure of the stones used in making it to hold their positions without moving, and so loosening the body of the roadcrust, and producing fatal disintegration. It was supposed by most people that the wear of the road was at the immediate suface only, whereas the actual injury caused by traffic not only affected the surface, but destroyed the entire roadcrust by causing movement of the stones in it far down below the surface. Examination showed that blows of the hoofs of the heavy cart-horse and of wheels where ever the surface was uneven, resulting in motion far down in the crust, caused the sharply-broken stones which had been laid down to move, and by chafing one against another to become loose in their seats more and more, until they resembled potatoes, from their angles being rubbed off. The road thus ceased to have any cohesion, so that the surface could not remain even, every horse or vehicle squeezing mud up in wet weather, and picking or pressing the stones out of their seats in dry weather. And this disintegration, being irregular in its effect at the surface, caused depressions in which water could lie. Every one knows what is the state of an ordinary road shaded by trees for many days after a fall of rain.

All this is, as regards the making or renewing of road surfaces or the construction of new roads, a thing of the past. Investigation and experiment have made it certain that a road can be constructed at a reasonable cost which will be impervious to water, will keep its surface unbroken for a long time, and which at any point where it shows signs of giving way can be made perfect by patching, without the Scriptural result of the new making the rent worse, as the quality of the patch and its surroundings will be practically the same. The lower crust of the modern road can be made so compact by the use of a well-proportioned, binding material of ascertained quality that the mass is held firm, and cannot disintegrate by its pieces being moved and made to chafe one another, so as to remove the sharply-angled surfaces and reduce the crust to a non-cohering layer of rounded pieces. Also, it can be so made that water will not penetrate as it does into a road the only binding material of which is dirt. A stretch of such road, after being under traffic for two years or more, will be found with every stone still in the exact position in which it was fixed at first laying; and so tenaciously are the stones held by the well-chosen, binding material that if a block cut out of a road is broken in two,it will be found that the stones are so firmly fixed that where the split comes opposite them they break across, leaving one half-fixed in each of the two pieces of the specimen of crust. No stronger testimony could be given to the excellence of the crust than this real evidence of the firm grip of the binder.

But another improvement has been developed. Just as a carpet placed on a floor prevents vibration and deadens sound, so in the case of important roads in city or country combinations of bitumen with other materials are now used to put, as it were, a resilient carpet on the top of the resisting road-crust, with the effect not only of lightening the blows of the traffic and so protecting the material below, but also of diminishing noise, saving wear and tear of vehicles, their frames, their tires, and their springs, and giving a greater mileage per gallon of petrol than can be the case if the road at the surface is rigid and in measure uneven, as it must be when the crust is exposed to the direct stroke of traffic of all classes of vehicles. Such a superimposed surfacing acts exactly as does a carpet in a room. It is slightly depressed where pressure comes on it; but when left alone, or when pressure comes on the carpet close to the depression, the depressed part rises again into position. A good turf is just an outdoor carpet. The foot of man or horse depresses it, and thus it is relieved from hard going; the turf rises again, either by being pressed down at a point close to the former depression or by being left untouched, and by its elasticity rising once more to the level. The bituminous surface which can now be put upon a road acts as the elastic turf does on a lawn; it yields, although of course in a slighter degree than the turf, and recovers, and so violence tending to destroy the weight-bearing crust is warded off. More durability is thus given to the body of the road, and an impervious surface is maintained. There is good reason to hope that roads covered with such a surface, proportioned in its thickness to the character of the traffic on the particular road, will last and remain in good order for a much longer period than has ever been the case hitherto, provided only that it is sufficiently inspected, and any incipient injury is dealt with at once. The repair of the road surface is easy, and if properly done gives as good and smooth a surface as ever.

With such good prospect before the community, there is one other matter which calls for legislative intervention. The burden of road construction and maintenance falls in the most uneven and unfair manner upon many localities. There must be good roads provided between the great centres of population, and as matters at present stand the burden of doing this is in many cases most unjust to many districts. Such a road as that between Glasgow and Carlisle, or that between Carlisle and Preston, ought to be made and maintained in the best manner. But to put such a burden for many miles upon low-rented pastoral subjects such as are found for miles on either side of Beattock Summit or Shap is most inequitable. Main roads such as these, and all other roads which can be classed as main roads, should be matters of Imperial concern, so that the burden of construction and maintenance shall not fall oppressively upon poor localities. It is satisfactory to know that a move in this direction is being made. The Road Board is engaged in obtaining statistics of traffic, with a view to classifying roads and formulating a better system by which the burden may be more equitably distributed than at present. When a proper classification is provided, so that the roads which ought to be of first-class construction, are scheduled, there is no reason to doubt that the engineer will be able to give a specification for road construction which will make it certain that the main road of the future will be a dustless, mudless, smooth, and durable way, and that the cost, spread over a period of years, will not be greater than, if so great as, has now to be encountered to keep up a road passably good but inefficient to a considerable degree in the qualities of a truly sound and efficient road. This must be made a matter of State duty, so that the burden may not fall unfairly, and that the work may be done with equal efficiency throughout. It is "a consummation devoutly to be wished."

Meanwhile the assurance can be confidently given that the production of the dustless, smooth, and efficient road has passed from the experimental to the practical stage. It is for the legislature to give the impetus to its realization in fact.

Owing to the wide difference between five bids submitted for the western section of the intercepting sewer to serve Sandwich, Ojibway and Sandwich West, no contract has yet been awarded by the Essex Border Utilities Commission. Two of the bids were several thousand dollars lower than the engineer's estimate of $100,000, while the others exceeded the estimate by large margins.

Competition for business will undoubtedly be keen after the war.

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Water Supply System in York Township

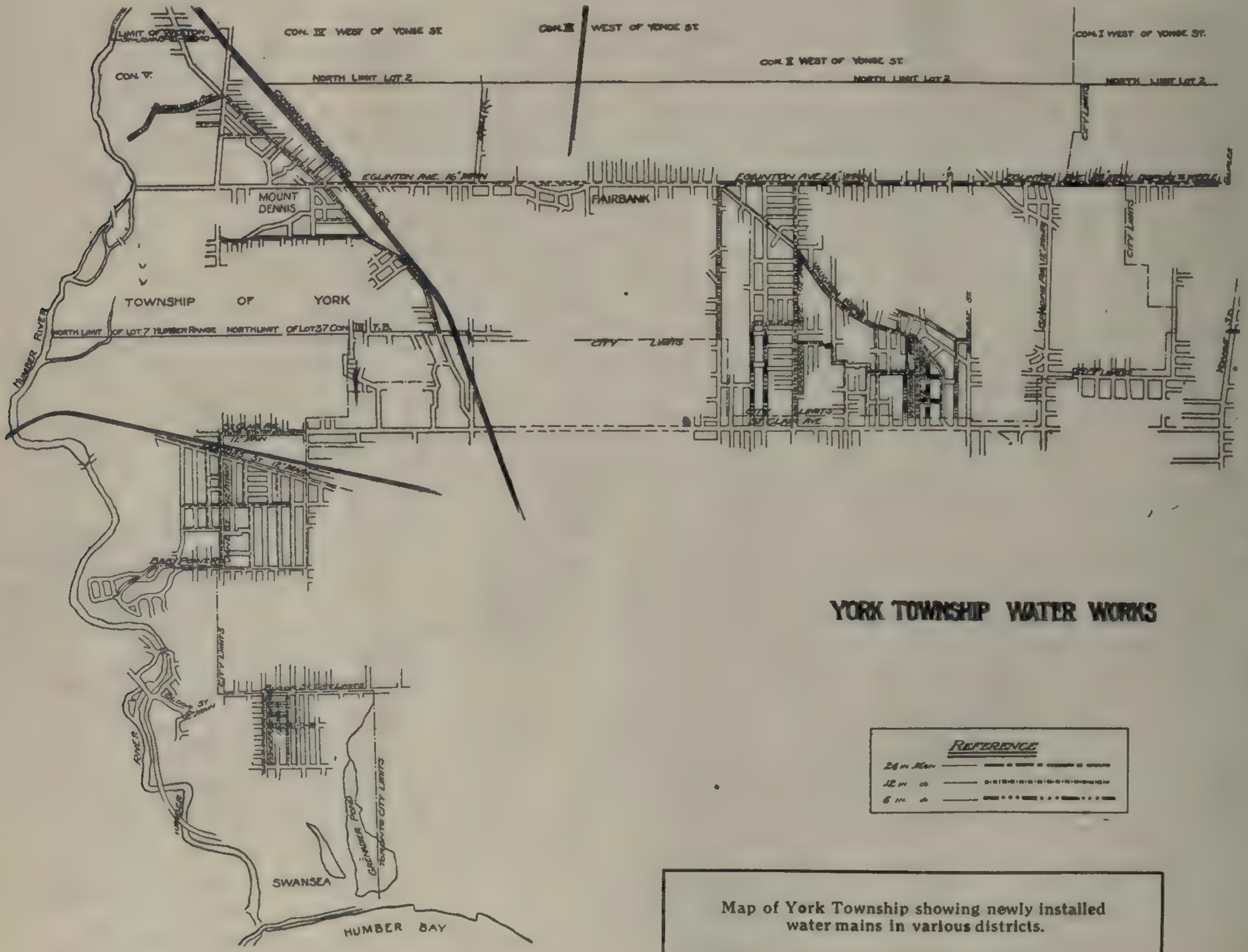
YORK Township is situated north and west of the city of Toronto, occupies an area of about 54,725 acres, and has an estimated population of about 34,000. The portions contiguous to the north and west city limits, covering an area of approximately 5,500 acres, and constituting the water supply sections, have a population of about 25,000, and this is rapidly increasing. The total taxable assessment of the township in 1918 amouted to $24,204,934, of which about $11,000,000 was on property included in the water supply area, extending from the vicinity of Avenue Road on the west to the Humber River and from Weston to the lake front.

York township has the greatest assessable value of any township in Ontario, and a very small debt for works of public utility.

As there was no municipal water supply available in the urban parts of the township, excepting for a short distance on a few streets adjoining the city of Toronto, house owners had to sink wells. The large number of such wells, more or less shallow in depth, and the location of cesspools in a populous district, caused the sanitary conditions to become unsatisfactory, and a menace to the inhabitants of the township. Furthermore, there is an intimate intercommunication between the township and the city, by virtue of the fact that a large number of work-people who dwell in the township are employed in the city, and moreover, many are engaged in munition works or in different vocations allied to munitions.

As there was a danger of contamination due to the proximity of cesspools to the water wells, and owing to the serious handicap and expense of having to dig wells, which often proved to be inadequate and had to be abandoned, the inhabitants during the last three or four years became most insistent that a comprehensive scheme of waterworks should be installed by the township. The council give this matter every consideration and endeavored to find a satisfactory and economic solution. They finally succeeded by negotiations with the Toronto City Corporation in obtaining the necessary supply from the city system; terms were agreed upon and special legislative powers from the Ontario Parliament were applied for and obtained in 1917.

After receiving the necessary authority, plans and specifications were prepared by Mr. Frank Barber, Toronto, for the more essential trunk mains. These



Map of York Township showing newly installed water mains in various districts.

were approved by the Provincial Board of Health, the Ontario Railway and Municipal Board, and the City Commissioner of Works, Toronto. The city authorities have the right to inspect the works as they progress, as it is anticipated that some day the limits of the city of Toronto may be extended to include parts of these areas.

Contracts were let and the following mains were laid in 1917 and 1918.

Eglinton Ave. (part) 24 in. dia., 13,800 ft.; Oakwood Ave., 12 in. dia., 6,510 ft.; Vaughan Road, 12 in. dia., 4,524 ft.; Wychwood Ave., 12 in. dia., 2,115 ft.; Weston Road, 12 in. dia., 8,735 ft.; St. Clair Ave., 12 in. dia., 4,400 ft.; Jane St. and Baby Pt., 12 in. dia.. 2,345 ft.; Windermere Ave., 12 in. dia., 2,066 ft.; Rogers Road, 12 in. dia., 1,114 ft.; St. John's Road, 12 in. dia., 2,750 ft,; Lambton Ave., 12 in. dia., 3,815 ft.; Dufferin St., 12 in. dia., 4,155 ft.; total 56,329 ft.. or about 10½ miles.

The contractors were: Eglinton Ave., Jane St., St. Clair Ave., Baby Point Rd., Windermere Ave., Messrs. R. C. Huffman & Co. Oakwood Ave., Vaughan Road, Wychwood Ave., Weston Road, Messrs. Mitchell & Mohan. Rogers Road, St. John's Road, Lambton Ave., Dufferin Street, Messrs. Orsiny Construction Co.

The 24-inch trunk main in Eglinton Avenue constitutes the principal artery of the system so far as it applies to Section A., and had to be constructed before it was possible to obtain a permanent supply in that section. The 12-inch mains are necessary to afford the foundation of a satisfactory distribution and circulation of the water supply. Consequently, it was expedient to construct these in the first part of the programme. The cost of the 24-inch trunk main is to be raised by a special rate on all the rateable property in Section A. The cost of the 12-inch mains is to be divided; 55 per cent. of the entire cost of the mains, together with the entire cost of the measuring equipments on the same. is to be raised by a special rate on all rateable property in the two sections, while the balance of 45 per cent. is to be raised on a local improvement basis and specially assessed on lots fronting and abutting directly on the works.

The council undertakes to lay water mains only where it considers that they are urgently required and can be of immediate use to the residents, so as to improve the conditions already referred to. The six-inch mains are laid as local improvements, that is, the Council finances the work and will be refunded the cost by the property owners in annual installments during a period of ten years. Building operations for about four years have been reduced to very small dimensions, compared with the needs of the district, because of the war and the difficulty of obtaining materials and labor at a reasonable price. There is a demand for houses, and when peace is declared the demand will be much intensified. It is therefore deemed expedient, as far as possible, to prepare facilities for home builders and to organize for future employment of the returned soldiers.

During the season of 1918 about forty 6-inch reticulation or distributing mains were laid extending over a total length of about ten and a half miles.

The contractors were Messrs. Peter Mohan, J. H. McKnight, Orsiny Construction Co., Angelo Cavotti, Godson Contracting Co., Grant Contracting Co., Constructing & Paving Co., and Routley Road Company.

The whole of the cast iron pipes and specials were supplied by the National Iron Works Co.; valves and hydrants by Messrs. Drummond McCall Co. and Bawden Machine Co.; lead by Canada Metal Company; Venturi meter by Messrs. Allen General Supply Co.; Helx meter by Messrs. Francis Hankin & Co.; valve covers by Messrs. Tomlinson & Co.

However, there are a large number of streets remaining for attention next season. The localities known as Fairbank, Silverthorne, Cedervale. South Swansea, Bathurst Street, Northland, and Spadina Road, are yet to be dealt with. The areas which require water are suburban in character and the magnitude of the undertaking is comparable to that needed for a city of over 400,000 inhabitants.

The supply of water will be by meter and the system is in charge of Mr. Hugh Hughes, superintendent of waterworks.

Water was officially turned on by Reeve Thomas Griffith on July 13th, 1918. The council consists of the reeve; first deputy reeve F. H. Miller; second deputy reeve Robt. Barker; third deputy reeve Wm. Graham; councillor Charles McKay; clerk Mr. W. A. Clarke.

The entire work was carried out under the direction of Mr. R. O. Wynne-Roberts, who is associated with Mr. Frank Barber.

The Painting of Iron and Steel

A remarkable discovery respecting the painting of iron and steel surfaces has recently been announced from the Continent, and is fully worth the careful consideration of engineers. It is to the effect that a single coat of paint has been proved to resist the rusting of the metal more than either two, three or four coats. This is so distinctly contrary to accepted ideas on the subject that it seems to be almost fallacious; yet when we come minutely to examine all the details there certainly seems to be some fundamental reason for it, and, like many other new suggestions, it contains a good deal of truth.

The experimenters cleaned a number of iron plates and gave them one, two, three and four coats, respectively. When the paint was thoroughly hard, dry and seasoned the plates were exposed for twelve hours to a steaming process. Then the paint coat dissolved off and the metal was inspected. That which received a single coat was found to be still bright and uncorded, while in the case where the four coats had been applied a layer of rust was evident upon it, and the other two examples displayed varying proportions of oxide, which was greater where three coats had been applied.

The Quebec Streams Commission has received tenders for the construction of a storage dam at the outlet of Lake Jacques Cartier. Laurentide National Park, 60 miles north of Quebec. The dam is intended to conserve the water at low water periods, and will serve several mills on the Jacques Cartier River. The area of the lake is four square miles, and the drainage area 82 square miles. The dam will be 310 ft. long, and 25 ft. high, above the bed of the river. It will be of the crib type, filled with stone, will rest on sand, and will be supported by wooden piles. To provide against the washing out of the bottom, a steel sheet piling core will be built, extending 35 feet below the bottom of the dam. A down-stream apron will be provided of such length as to nullify the pressure of the water. Two sluice gates, hand operated, and a log sluice will be installed. All the material will have to be hauled from Quebec.

The Making of Good Roads in Manitoba

Organization for Construction and Maintenance—Province Gives Financial Assistance—Fifty Municipalities are Building

By A. M. Lyons*

ROAD improvement in Manitoba is being carried on under "The Good Roads Act." This Act was passed in 1914, and provided for the borrowing of two and one-half million dollars for the construction of main market roads and provincial highways. On main market roads assistance is given by the Provincial Government to the extent of one-third (1/3) of the cost of earth roads and one-half the cost of gravel roads, and on provincial highways two-thirds of the cost is paid by the government. On all so-called permanent structures, such as those of concrete, masonry or steel on good roads, payment of one-half the cost is made and on wooden structures one-third the cost.

In 1915 an amendment was made whereby assistance is given in the building of bridges not on a good roads system; permanent structures costing $200.00 or over, one-half of the cost, and on wooden bridges costing $500.00 or over one-third of the cost.

Organization.

"The Good Roads Act" is administered by the Good Roads Board, consisting of three members, of which the Highway Commissioner is chairman. Attached to the Board are a "'Chief Engineer and such engineers, surveyors, inspectors, clerks, etc., as are necessary." The engineering staff is divided into two branches, bridge engineers and road engineers. The work of the bridge engineers extends over the whole province, but for the road work the province is divided into districts and a district engineer has charge of all road work, and general supervision of bridge work in his district. Where ever such assistance is needed, the district engineer has an assistant engineer. Where any large scheme of road improvement is being carried out in a municipality, that municipality is required to put a resident engineer on the work. The expenses of this engineer are charged against the cost of the road, and he works under the direction of the good roads district engineer. On bridge work the municipality is required to have a competent inspector on the work. The expenses of this inspector are charged against the cost of the bridge. This inspector is under the general supervision of the district engineer, and the direct supervision of the bridge engineer in charge of this particular bridge. All engineers and inspectors are required to report weekly to the Winnipeg office.

Application of the Act.

The primary intention of "The Good Roads Act" is to assist the municipalities in developing and improving a system of main market roads. To this end the municipal authorities desiring assistance under the Act must first lay out a system of market roads in their municipality and submit this system to the Good Roads Board for approval. The board then deputes an engineer to examine the scheme and report on its serviceability and probable cost. After the system has been accepted by the Good Roads Board, and by the Government by Order-in-Council, the municipality is at liberty to carry out the construction of the scheme with the expectation of receiving assistance from the Government.

"The Good Roads Act" provides three ways of financing this road work: by current revenue, by special rate or debenture issue. If by the last mentioned method, the road system and debenture issue must be approved by the ratepayers, before any further steps can be taken.

Up to the present, twelve municipalities have taken advantage of the debenture method for construction of roads. All works are to be done by contract unless another method is approved of by the Good Roads Board. All work must be carried out under the direction of a Good Roads engineer, who must verify that all works done are according to plans and specifications. To obtain the payment of the Government's portion, the secretary-treasurer of the municipality is required to send in a statement of the cost of the work, accompanied with necessary vouchers and a statutory declaration that the statement is correct.

Carrying Out of the Work.

In the bridge work, about 95 per cent of the work is done under contract and about 75 per cent of the road work. While in a number of cases roads constructed by day work with local labor has been cheaper in first cost, when the finished appearance of the work is considered the contract work is, in 95 per cent of the cases, more satisfactory, and any slight extra cost is justified. The municipal authorities are becoming more favorable each year to let work by contract even at a slightly higher cost. Having work done by contract does not always insure a good piece of work, but a class of contractors is being developed in Manitoba who will turn out good work, and as this method of doing work is carried on, the difficulty of securing a satisfactorily finished road will become smaller. This year's contract price varies from 15 cents per cubic yard to 38 cents, depending on the nature of the soil, and the type of the contractor. Some of the small contractors doing perhaps one or two miles of road, and who only expect to work for a short while in the farmers' slack time in summer, do work as low as 15 cents per yard, where all the work is side-work. A contract for nearly ten miles of gravel road, where there were old ditches, but little overhaul, was let for 28½ cents per cubic yard. A contract for 24 miles in Sifton Municipality was let at 30 cents per cubic yard. About five miles of this contract will be quite wet and another two or three miles very sandy. Some parts there will be considerable end haul, mostly within the free haul limit. In another municipality a contract was let for 27 miles at 31 cents. A large amount of this was end haul, coming just within the free haul limit. The free haul limit is in general one hundred (100) feet with one per cent. station yard overhaul.

In many portions of Manitoba the scraper is about the only way of building roads. In some places, however, the push-grader can be used. One municipality, which intends to construct about 200 miles under "The Good Roads Act," and which has already passed a Debenture By-law for $171,960.00, has purchased a 60-80 Twin City traction engine and two 12-foot blade Russell graders. The district engineer in charge of this work is keeping careful records of the cost of the various items in this work and we hope to have some valuable data in this connection for this year's report.

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*Chief Engineer Highways Department—Before the Engineering Institute of Canada.

Material.

The soils of Manitoba vary from the heavy gumbo to pure sand. The gumbo, when dry and properly dragged, makes an excellent road, but when soaked with water is almost impassable. Wonders can be worked with this class of soil through good side drainage, a good crown and, above all, a properly maintained surface. Gravel surfaces have been built on some gumbo roads and about 12 inches of gravel are required before the surface is satisfactory. The first coat of four inches will probably disappear entirely; the second coat of three inches will leave its mark; the third coat of three inches, it begins to look like a gravel road, and two inches more of fine material makes a very good surface. Unfortunately, in much of the gumbo region, gravel is scarce. On one of the main roads, on which grading has just been completed, it is intended to construct a sand-clay surface, using sand from the Assiniboine River, which closely follows the road. In the Western portions of the Province, about five inches of gravel makes an excellent road. This is applied in two coats; one 3 inches, and one 2 inches. In some of the sandy country a good road has been built by the addition of about six inches of clay and again covering the clay with an inch or two of sand. In some parts of the southwest the light drifting sand has been treated by working straw into the grade, and when this has been thoroughly mixed in, to cover the surface with gravel. The gravel in this district has a large amount of soft limestone which cements quickly under the traffic and moisture.

Engineering.

In the construction of roads, great care is taken to provide suitable side-drainage. This is sometimes quite a difficult task, especially in the Red River Valley, where the country is quite level. Deep ditches along the road are being avoided whenever possible, but this is not always possible without going on to private land or making long off-takes. The only proper drainage of country is along natural drainage lines, whether for farm drainage or road drainage. But in Manitoba to attempt to open up drains across fields would often lead to unpleasant consequences. Therefore the road allowances carry many ditches which should not be there and the safeness of the road is endangered. In the cross-section of the road we are eliminating a berm wherever possible. We give the road a crown of one inch to the foot, and a slope of four or five to one to the ditch, and about three to one on the outside of the ditch. This makes a road which is pleasing in appearance, safe for nervous horses, easy to maintain, and has good transverse drainage. Our ordinary market roads are 18 feet wide and more important roads are 20 to 24 feet wide. We try to keep grades down to 5 per cent., but it is not always economical to do this. so that grades as high as 7 per cent are in use, and in a few cases, 10 per cent. Culverts are made with a minimum length of 24 feet between headwalls.

"The Good Roads Act" provides that all roads built under the Act must be satisfactorily maintained by the Municipality. If this is not done, the Municipal Commissioner has the power to have it done, and assess the cost of the work to the municipality. In nearly every case, however, the municipalities are taking great interest in the maintenance of roads. In many places good roads dragging districts are formed and prizes offered for the best maintained roads in the district. This year the Provincial Government has offered two splendid prizes for competition in road maintenance; one for gravel roads and one for earth. The Government also will pay to a municipality $3.25 per mile per season, (up to two hundred and fifty dollars, ($250.00) per municipality) for any road properly maintained throughout the season. The Government also provides the services of an expert dragman and grader man, whose services are free to any municipality for demonstration in dragging or push-grader work. For earth roads the plank drag or steel drag is used, generally the latter. While the plank drag probably gives better results if used at the proper time, in most cases the road is not dragged until it has pretty well dried out in which case the steel drag gives better results. For gravel roads we have found the Minnesota Plainer to be by far the most satisfactory implement for maintaining a smooth surface on this type of road.

At present about 50 municipalities are building roads under "The Good Roads Act," and 1900 miles have been accepted by the Good Roads Board. 365 miles of earth roads and 191 miles of gravel roads have been constructed up to the end of 1917, and 190 miles are under construction. 150 concrete structures; 31 steel structures and 49 wooden structures have been built up to the end of 1917. This year about 65 concrete structures and 14 wooden structures will be built. Up to the end of 1917 the Government had paid $680,000.00 as its share of work performed under "The Good Roads Act."

New Books

The Building Estimator's Reference Book—By Frank R. Walker—second edition; published by the author, 168 North Michigan Ave., Chicago. This is a practical reference book for contractors and estimators engaged in figuring the cost of all classes of modern buildings. It gives the actual labor cost and methods employed in a number of our present-day structures, together with material prices and labor quantities entering into the erection of all classes of buildings. The contents are arranged under the following chapter headings: general conditions and overhead expense; excavating and back-filling, caissons, wood and concrete piles; concrete for footings and foundations; water and damp proofing; concrete floor, walks, street paving, etc.; reinforced concrete construction; brick masonry; rubble stone work, cut stone, granite, and architectural terra cotta; hollow tile fireproofing; rough carpentry, timber framing, flooring, lumber, etc.; mill work and interior finish, erection of same; lathing and plastering; fire retarding doors and windows; sheet metal work, cornices, skylights, etc.; roofing, slate, tile composition, etc.; exterior and interior marble, slate and scagliola; interior tiling, floors, wainscoting, mantels, etc.; glass and glazing; painting and varnishing; structural iron and steel; miscellaneous and ornamental iron; miscellaneous building specialties, vault doors, prismatic sidewalk lights, blackboards, etc.; rough and finish hardware; electric wiring; automatic sprinkler systems. Price, $5.00; size, about 4½ in. x 6½ in.; 3,500 pages.

Mainly Constructional

East and West—From Coast to Coast

The Pacific Sheet Metal Works, Limited, has been incorporated with a capital of $50,000, head office at Vancouver.

The section of the Bloor Street Viaduct, Toronto, from the head of Danforth Ave. to Parliament St., was officially opened on Friday, Oct. 18th.

At a recent meeting of the York Township council, a deputation of the Todmorden Ratepayers' Association came before the councillors to request the immediate survey and early construction of a roadway and high level bridge connecting their district with Leaside.

A firm recently incorporated under the name of Merkleys, Limited, with a capital of $150,000, is authorized to carry on business as manufacturers and dealers in lumber, shingles, woodenware, building material, bricks, tiles and drain and sewer pipes, and such like productions. Its head office is at Ottawa.

The contract for the erection of the proposed new school on the northwest corner of Ottawa and Main streets, Hamilton, has been let to the Frid Construction Company, whose tender was $258,800. Other expenditures, including $35,000 for heating, plumbing and wiring, and $14,690 for architect's fees, bring the total up to $380,490. The new building will have 26 classrooms and an auditorium.

Some seventy delegates from Grimsby, Strathroy, Brantford, Windsor, Paris, Tilbury, Ingersoll, Harley, Glencoe, London, Chatham, Hamilton, and many other points recently attended a meeting of the "Provincial Highway Association, Windsor to Toronto and Niagara Falls, via Hamilton," held at Woodstock, Ont. After lively discussion, a resolution was drawn up, which will be incorporated with similar resolutions presented at meetings held in Brantford, London, and Hamilton, and will be presented to the Prime Minitser and Minister of Public Works in Toronto early next month. It was agreed to send a large delegation to Toronto, but have only a few men address the Premier and the officials. Later a sort of "follow-up" delegation, composed of only a few men, is to again take the matter up with the Premier. The body of the resolution reads as follows: "That the Government of the Province of Ontario be requested to at once designate and locate the proposed Provincial highway as running from the city of Hamilton in a westerly direction through Brantford, Woodstock, Ingersoll, London to Lambeth, Wardsville, Bothwell, Thamesville, Chatham, Tilbury to Windsor, connecting at the city of Hamilton with the present Toronto and Hamilton highway; also with the highway already designated as a Provincial highway running from the city of Hamilton to the Niagara frontier, and at the city of Toronto connecting with the portion of such Provincial highway running easterly to the boundary of the Province of Ontario and the Province of Quebec."

Personals

Brig.-General J. Stewart, of the Canadian Stewart Construction Co., who has been in the Imperial Service for some time, has lately been appointed Director-General of Construction in the British Army, with supreme command over all railways, docks, etc.

Mr. S. A. Armstrong, whose resignation as Deputy-Minister of the Department of Soldiers' Civil Re-establishment was recently announced, has gone to Chicago to take the position of vice-president of the American Underfeed Stoker Company. Mr. Armstrong was originally appointed Director of the Military Hospitals Commission in December, 1916, and to him the greatest credit is due for the success which attended the organization and work of that Commission and the department which superseded it. He is succeeded by Lieut.-Col. Frank P. Healey.

Col. J. S. Dennis, C.M.G., has been appointed Canadian Red Cross Commissioner for Siberia, and thus will have charge of the distribution of all supplies sent to Siberia by the Red Cross. At present he is directing the transportation of the Canadian Siberian Expedition. Col. Dennis is a member of the Russian Investigating Committee, and from his residence in Russia and in North-West Canada has become acquainted with conditions in Siberia. He has not severed his connection with the C.P.R., but has been loaned by that company to the government for his present work. It will also be remembered that for the past fourteen months Col. Dennis has been acting as second in command of the British Recruiting Mission in the U.S.A.

Mr. Emmanuel Mavaut, formerly with the Public Works Department, Ottawa, recently joined the staff of engineers of the Milton Hersey Co., Ltd., as director in charge of the cement, sand and stone testing laboratories. He has had many years' experience in testing building and structural materials, especially with cement, sand and stone. For three years, Mr. Mavaut was engaged testing building and structural materials for the Public Works Department, and later was appointed assistant director of the same laboratories, a position he held for nine years. In January, 1916, he joined the Canadian Inspection & Testing Laboratories, Montreal, as director of the cement laboratory, and now acts for the new company in the same capacity. The laboratories of the Milton Hersey Co. are now being equipped with the best appliances for testing cement, and Mr. Mavaut is engaged on a campaign directing the attention of engineers, architects and contractors to the importance of having all building and structural materials tested and inspected.

Obituary

Mr. George Smith, manager of the Ontario Wind Engine and Pump Co., Toronto, died on the 13th from pneumonia, which set in as a development of the influenza. The body was taken to Thornbury, Ont., which was the home town of the deceased.

Lieut. Robt. S. Johnston, an American civil engineer, loaned by the U. S. government to the Dominion government for duty in connection with the erection of naval air stations on the Canadian coast, has died as a result of an attack of influenza. He was a native of Ireton, Iowa, and was only 27 years of age.

Lieut. Walter J. Murray, architect, of Montreal, has died from wounds received in France. He went overseas as assistant-adjutant of the Irish-Canadian Rangers, was later transferred to another Montreal battalion, and died in hospital at Epsom, England, of gunshot wounds. At the time of enlisting he was practising as an architect with the firm of Messrs. Pedan and McLaren.

Mr. Fracis J. Cronk, M.Sc., assistant professor of Railway Engineering at McGill University, and an associate member of the Engineering Institute of Canada, died in the Western Hospital, Montreal, on October 11, from pneumonia, following influenza, aged 31. He received his degree at McGill University in 1914, and occupied various positions on the engineering staffs of Canadian railways. He was a native of Montreal.

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Speedy Action is Required to Relieve the Housing Situation

THE housing question has been discussed and re-discussed by the councils of many of our towns and cities. Committees have been appointed to handle it, and their reports have been referred back or rejected. There has been talk, interminable talk, but, in most cases, no definite action. Will it remain thus until action is forced by the sheer extremity of the situation? If there is a shortage now what will be the condition when several hundred thousand men return from Europe?

In a city such as Toronto the starting point of any industrial housing development must either be the old central portion of the city or the outskirts. If we begin at the centre, we must of necessity increase the number of dwellings in an already frequently congested district. Sometimes, of course, the arrangement has been so poor that while a street has a crowded and huddled appearance, there is, in reality, certain space available, because it has not been used to the best advantage; there are many large old houses, relics of a formerly opulent neighborhood, which now are harbors of filth and disease germs, and which might be replaced by neat and sanitary dwellings. The convenience of living in a down-town section is a big consideration with many workers, but the conditions are not so healthful, and indeed for children they must be considered little short of impossible.

Living on the outskirts also has its disadvantages. There is the problem of transportation to be considered—it is more or less of a hardship for a man to have to spend, say, from forty minutes to an hour going to his work and the same length of time returning. And particularly at the present time, the fuel problem is also one that cannot be overlooked. A warm house, or one that is comparatively warm, has much to commend it, and it is probably safe to state that in districts such as Earlscourt, Toronto, where unsheltered frame houses got the full sweep of the blizzards from every direction, there were few warm spots last winter. Congestion, under some conditions, has advantages; it means greater shelter.

However, the great difficulty, both in the centre of the city and its outskirts is that the development has been haphazard, and that the proper type of dwellings has not been built. As it is considerably easier to remedy conditions in the suburban areas and to proceed along the right lines, it is there that any scheme for the immediate relief of the situation should start. At the same time, the down-town sections should not be neglected; there are quarters in which the congestion must be relieved, and others in which more advantageous use can be made of the available space.

The next question to be considered is the type of house to be built, whether detached, semi-detached, or in terraces. The terrace idea is not very popular, but it has some slight advantage in cost of erection, and it is easier to heat. The objection usually raised to it is the lack of privacy; yet it does not seem that the party wall permits of any more unintentional intercourse between neighbors than do open windows, a few inches apart. Of course, if some attention is not paid to architectural appearance, terraces may be ugly and monotonous in the extreme, but if a little care is exercised this feature may be overcome, and for some classes of workers they are probably the most suitable.

As to the type of construction, concrete appears to have certain advantages for industrial dwellings—it is comparatively cheap, it is permanent, it is sanitary, it permits of quick erection. There is again, of course, the difficulty regarding the outward appearance, but this is not insurmountable. Standardization, to some extent, is absolutely necessary in order to reduce the cost, but where there is sufficient space available, it is not difficult to introduce sufficient variation to prevent monotony.

At the present time, such is the condition of the market for both labor and material, builders are unwilling to put capital in the erection of the industrial type of dwelling. It is not a safe investment from their standpoint, particularly as private corporations are showing a tendency to go into the building business to provide accommodation for their employees. Neither is it in the best interests of a municipality that houses of this type should be built more or less indiscriminately at different points by various builders. The proper solution to the problem under the present abnormal circumstances, and even, we believe, under any circumstances, is that the municipal authorities should outline a definite programme and should let contracts for carrying it out. This, indeed, is what a number of them have been attempting to do, but there has been so much difference of opinion, so much overlapping, so much working at cross purposes, that very little has been accomplished.

However, something must be done, and done immediately. The longer the delay, the greater will be the difficulty experienced, and we must be prepared to receive the men from the front when the war comes to an end, whatever the effort and whatever the expense necessary.

Avoid Accidents in Construction

CONSTRUCTION is classed as a hazardous industry, but it is largely the fault of those engaged in construction work that it should come under this classification. We have a tendency to consider construction hazards as not practicably avoidable, and to accept these accidents as inseparable from the performance of this kind of work. In this conclusion we are certainly in error, as by far the greater number of accidents which occur in construction work are entirely avoidable. Even those which might occur despite precaution could, to a great extent, be prevented from becoming serious.

Certain construction firms have systematically developed accident prevention methods in prosecuting their work so that they have greatly reduced the number of accidents, and still more greatly reduced the cost of accidents. Contractors should study, carefully, accident prevention in construction. By so doing they will help themselves while helping others.

Aggregates for Concrete

THE investigation now being made by the British Concrete Institute, under the auspices of the Department of Scientific and Industrial Research, into the nature and properties of the various aggregates for concrete, is one of considerable importance. The investigation is a recent development of research work commenced some time ago, and it is satisfactory to know that an effort is being made to obtain information by means of a circular letter addressed to county engineers throughout the country, and that the co-operation of the Geological Surveys of Great Britain and Ireland has been secured.

The necessity for precise knowledge as to the quality and characteristics of aggregate has frequently been emphasized in the Contract Record. There can be no question that the quality and properties of the aggregate determine, to a great extent, the strength of the concrete. The writer's experience is that in the majority of cases where good, hard concrete has been tested to failure the fracture has occurred through the aggregate rather than the bond.

In this connection considerable interest has been created in the recent tests of Captain Llewllyn Edwards to advance his argument that the strength of mortar and concrete is directly proportional to the relation existing between the proportion of the cement and the surface area of the sand or sand and aggregate, as the case may be. On the other hand, Professor D. A. Abrams, of the Lewis Institute, Chicago, claims that the strength of mortar and concrete for given materials varies solely with the relation between the amounts of water and cement in the mixture.

It has been generally recognized that an excessively wet mixture does not produce concrete of the maximum strength and the introduction of certain varying proportions of hydrated lime has been tried out to obtain a workable mixture, using a smaller amount of water than would otherwise be necessary. These tests appear to substantiate Professor Abram's claim as a much higher compressive strength was obtained by the introduction of hydrated lime.

From the universal interest created in the result of these experiments it would appear that engineers are not satisfied that we are obtaining the best results from the practice in general use. For a long time we have been satisfied with the rule of thumb method. Now that scientists have seriously taken up the question we may expect to have the work of the man on the mixer placed more nearly on a scientifically correct basis.

Water Softening Helps Conserve Fuel

BY chemically softening hard water used in boilers, scale formation may be very much reduced, if not entirely prevented, consequently resulting in an appreciable saving of fuel. Certain kinds of water cause heavy scale deposit on the boiler flues, and firing, where this deposit eixsts, calls for increased fuel consumption representing waste.

The plant necessary in the process is quite simple. It consists of an outside tank, within which is a draft tube. Into this the raw water enters and is mixed with chemicals which release, as insoluble compounds, the objectionable elements in the water. Within this tube is an agitator which keeps the mixture uniform and thorough. When the water has gone through the softening process, it is retained in the space between the draft tube and the outside tank wall. When the contents have attained a fixed level in this compartment, the softened water flows, by gravity, to the boiler supply tank, and from there to the boiler.

The Kaiser does not want you to Buy Bonds.

Testing Driers for Quality

The qualities required in a drier are: That it should make the paint dry without discoloration, without making it brittle, without softening its surface, and with a minimum quantity of added bulk.

It is best tested by adding to it a good, genuine white lead and pure raw linseed oil. If 1 lb. of white lead be thinned with linseed oil, and sufficient driers added to cause it to dry in twelve hours does not discolor it or make it brittle, or interfere with its body or covering power, or cause it to become tacky, there will be little the matter with the driers. A fair comparison may be instituted by using sugar of lead with a similar quantity of white lead and linseed oil, and comparing the resultant paint both in the can and when dry.

As a test of value, of course the drier that does its work most effectively and innocuously is the cheapest, even if it cost more per hundredweight. If patent driers skin over with a brittle, glassy skin in the cask, or work either shorter or more leathery than white lead, or turn very brown on exposure to the air, they should be rejected.—Decorators and Painters Magazine.

Water Powers in the Maritime Provinces

By Mr. K. H. Smith*

SINCE 1915, active water power investigations have been carried on in Nova Scotia by the Nova Scotia Water Power Commission in co-operation with the Dominion Water Power Branch.

It has been necessary of course to give primary consideration to hydrometric work, that is the securing of adequate run-off data, of which none whatever were available in Nova Scotia prior to the inauguration of the work herein mentioned. During the past year, too, the necessity of making every possible man available for immediate military duty has further curtailed detailed power and storage surveys.

However, power investigations to date in Nova Scotia have revealed power sites with a total 24-hour capacity at all seasons of the year of about 100,000 horse-power. Maximum advantage of all these sites may be secured due to the large storage reservoirs at each site. Under such conditions, the installation warranted for the sites in question for ordinary commercial purposes would be from two to three times the 24-hour capacity given.

It is to be understood that the estimate given above is only for such power sites as have been investigated to date and that a number of rivers on which power sites of considerable magnitude are known to exist have not yet been investigated. It should be noted, too, that a water power site located at any place within the Province of Nova Scotia is within easy transmission distance of some industrial centre or shipping point.

At its last session, the Government of Nova Scotia passed a Water Power Act designed to place the local government in control of all water powers with a view to removing, as far as possible, legal obstacles, and facilitating in every way legitimate water-power development. The effective carrying out of this Act depends upon regulations which have not yet been put into force, but it is expected that such regulations, worked out in co-operation with other parts of Canada will be made operative at an early date.

During the past summer, a water power commission, consisting of C. O. Foss, Chairman, B. M. Hill, and W. E. McMullen, Secretary, was organized in New Brunswick. The members of the Commission are all employed by the New Brunswick government in other capacities, and it is especially noteworthy that they are all engineers.

This Commission entered into a co-operative arrangement with the Dominion Water Power Branch, Interior Department, Ottawa, similar to that in operation in Nova Scotia. Water power investigations in the provinces of Nova Scotia and New Brunswick, including hydrometric surveys may therefore be carried on by a single engineering organization which results in maximum economy and efficiency.

As was the case at the beginning of investigations in Nova Scotia, attention is being concentrated in New Brunswick on hydro-metric work. While New Brunswick was in a somewhat better position in this regard than Nova Scotia, due to the activities of the bordering state of Maine and of the former International Commission, pertaining to the St. John river, still there were no run-off data for the greater part of the province. Although active work was not begun until August, 10 gauging stations had been established up to the end of September, and about 20 current meter measurements made. It is considered that these stations with one or two others to be established and those now or formerly maintained by the United States Geological Survey will give fairly satisfactory run-off data for all parts of the province.

It may be interesting to note that results from one of the new gauging stations, that on the Madawaska river, are of value to the province of Quebec, as well, and as the station is actually located in that province, the Quebec officials are assisting in its maintenance. In this particular instance, therefore, there is co-operative action between the Federal government and the two provinces of New Brunswick and Quebec with one other province, Nova Scotia, indirectly interested.

Possibly some delay in undertaking water power investigations in New Brunswick may be attributed to the fact that in the past, there has been a general impression that the province of New Brunswick was deficient in water-power. Exception was made in the case of one or two outstanding powers which were too large or too far removed from industrial centres to warrant immediate development and certain international powers on the St. Croix river.

In the course of a reconnaisance of the province primarily for the location of steam-gauging stations, a number of small or moderate sized sites have become apparent, some of which offer promise of economic development at an early date, either individually or in conjunction with others. At the same time, it is quite possible that some sites which have not been considered favorably hitherto, due to a lack of storage reservoirs and a consequent great diminution of power at certain seasons of the year, may be developed in connection with steam generating stations located at some of the New Brunswick mines to great advantage from the standpoint of cheaper power and conservation of coal resources.

For obvious reasons there has been very little actual water power development in the Maritime provinces recently.

In Nova Scotia a water power plant supplying the town of Oxford, has been improved and enlarged, including the construction of a steam reserve to utilize mill waste near at hand. The village of Lawrencetown, Annapolis County, is now installing a water power plant on the Annapolis River immediately in the village to replace a steam generating plant, the cost of operating which was found prohibitive. The town of Annapolis Royal has also made a start towards increasing the storage capacity of their municipal water-power plant.

Middleton recently bought a water-power plant about three miles from the town, which had been inoperative for some time. With a few minor repairs and the building of about 3 miles of transmission line, this development was put into service at once, replacing a gas-producer generating station. In addition to its former lighting load, the town is now supplying industrial power, and recently connected up the largest individual power user in the community who formerly had steam equipment.

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* District Engineer for the Maritime Provinces, of the Dominion Water Power Branch, Department of the Interior.

In New Brunswick, a small water power development was completed some months ago to supply lighting, and industrial power in small amounts for the towns of Rexton and Richibucto. At the present time, a 2000-k.w. Hydro-electric station of excellent design and construction is being built on the Madawaska river at Edmundston. This development is intended to supply power for a large sulphite mill also under construction at the same place for Fraser Companies, Ltd.

In general, it may be said, that never before in the Maritime provinces were so many major power projects under serious consideration, and it seems quite probable that considerable development will take place at the first favorable opportunity. In a few cases, responsible parties are pressing to have the legislation recently enacted in Nova Scotia as outlined above made operative so that preliminary operations may be undertaken almost immediately. At the same time requests are being made for similar legislation in the province of New Brunswick.

Annual Inspection of Toronto Harbor Work

THE Toronto Harbor Commission's annual inspection of the work being carried out on Toronto Harbor took place on Oct. 18th, representatives of the board of control, the city council, the board of trade, and the city Hydro-electric Commission being present. A special feature in connection with the inspection trip was the formal opening of the new lift bridge connecting Cherry street with the new industrial area.

At a luncheon tendered the party in the Sunnyside Pavilion, which is operated and controlled by the Harbor Commission, Mr. Lionel H. Clarke, chairman of the commission, referring to the progress of the work, made strong complaints regarding the failure of the railways to carry out their part of the agreement in connection with the construction of the Esplanade viaduct, and the action of Hon. F. B. Carvell, Minister of Public Works, in calling a halt on important work in connection with the harbor development scheme which the Government had promised to do. It was pointed out that great loss was sustained by reason of the refusal of the Minister of Public Works to provide $154,000 to complete the sea wall at Sunnyside.

General Manager E. L. Cousins, who also spoke, said it had been a matter of great encouragement to the Commissioners to have been successful in locating, on over 90 per cent. of the newly-leased lands, industries engaged in war work—that is, either in the manufacture of munitions or the building of ships for war purposes.

In the Eastern Harbor Terminals 23,458 feet of dock walls have been completed, and of the above mentioned amount 10,533 feet are now under lease and occupancy. That portion of the Eastern Harbor Terminals, north of the ship channel and from the east limits of the Bay easterly as far as the turning basin, a distance of about one and one-quarter miles, is now reclaimed and ready for occupancy. This area consists of 320 acres, and to date 168 acres have been leased. Chief of these industries is the British Forgings Limited. The turnover in the Ashbridge Bay plant of this company—exclusive of the forgings plant in the west end—is between $600,000 and $650,000 per month. The number of hands employed at Ashbridge Bay is 1,600. The expenditure upon the steel and forging plant has been about $3,000,000. The amount of this expenditure amortized through the operations of the plant up to September 1st was $1,200,000.

In connection with the development of the inner waterfront, between Bathurst and Cherry streets, a distance of about two and one-quarter miles, work was commenced on this section in the year 1915, and to date 4,200 feet of dockage has been completed. The Commissioners had contracted work from Bathurst street as far east as York street, but on account of the financial situation, as a result of the war, were compelled to postpone some of these contracts to a later date, with the result that up to the present time the work has only been completed to a point near John street From Bathurst street to Spadina avenue the Commissioners have leased a site of some fifteen acres to the Dominion Shipbuilding Co., Ltd., on which is being erected one of the most modern shipbuilding plants on the Great Lakes. To the east of Spadina avenue the Dominion Government Department of Public Works will occupy one of the sites, and all that remains of the reclaimed property to be leased is one site of about 180 feet wide by 300 feet long.

The T. Eaton Co., Ltd., and the Harbor Commissioners have practically concluded negotiations for a site for what is understood will be the largest mail order building in the world, to be located between Yonge and Bay streets on what is known as Bayside Park. This building will be 750 feet long and 150 feet high, and will cost approximately $4,000,000. On account of the steel situation the construction work on this building will not be proceeded with until after the war.

Rubbing Down

Glasspaper and pumicestone are both used for rubbing down work to a smooth surface. The former for newly-painted work, or for water paint, distemper or soft surfaces—such as leather, paper, etc.; and the latter for old and hard paint upon hard surfaces—such as wood and iron, or non-porous walls.

Glasspaper when used upon soft paint will clog. To avoid this, the paper should be occasionally rubbed on a lump of chalk, or the work dusted with a little whiting prior to being rubbed down. After rubbing down, the work should be well dusted, and painted work is improved by rubbing over with a damp chamois leather. For large, flat surfaces a cork block is used under the glasspaper to keep the surface even.

Pumicestone is always used with a lubricator—either water, oil, or sometimes paint. The most usual is water. Soda or lye, ammonia or paraffin, are used in conjunction with water to assist the wearing down process upon old and tough work. They do not, however, improve the smoothness and level of the work, but rather dissolve the paint surface.

If the pumice gets clogged up it should be rubbed upon a Yorkstone slab.

There is a patent composition of block pumice that is an improvement on the old, raw material, being even in grain and not liable to clog or fur. It is made from powder pumice, and may be had in various degrees of grain.

New School and Residences at Verdun, Quebec

CONSTRUCTION work has been started by Mr. J. A. Leclair, of Verdun, for the Roman Catholic School Commissioners, on a school with two residences incorporated in the same building, from plans by Mr. J. E. A. Benoit, architect and engineer, Verdun. The plans provide for a large school in two sections, one for girls and one for boys and residences for the teaching sisters and brothers at either end of their respective sections of the school. The building, three storeys in height, is at the corner of Reille and Willibrords Streets, Verdun; the site of the school measures 140 x 63 ft., and the residences each 50 x 53 feet, with a playground along the whole frontage.

The exterior is quite plain, and is to be of St. Lawrence rustic brick, with Montreal limestone trimmings for the windows, at the front elevation, and plastic brick for the rear and side walls. The interior walls will be rock wall plaster on metal lath, and the ceilings of embossed pressed steel, supplied by the Pedlar People, Ltd. The floors are of hardwood, with the exception of the passageways, vestibules and lavatories, which will be of tile. The staircases will have steel treads and platforms. The interior wood trim is of red pine. Ventilation is on the Eloin system.

The two sections of the school are divided by a brick wall running from the ground to the roof. These sections are identical in construction and layout plan. The residences on either side communicate with the school by entrances on the ground floor, leading to inner staircases, which give access to the class rooms on the different floors.

The ground floor plan calls for two large recreation halls, and at the rear, furnaces, coal storage, and lavatories at either side of the coal bins, as shown in the illustration. The lavatories and the recreation halls are cut off from the furnaces by brick walls, isolating the furnaces from the school proper. Passageways between the recreation halls and the lavatories lead to entrances in the rear.

The two other storeys are devoted to class rooms, eight on each floor, four for girls and four for boys. The class rooms are to be 24 x 28 feet, and each will have cloak and hat room accommodation. A tiled passage way will run down the centre of each class room floor, the rooms being on either side. Lavatories are to be provided at the ends of the passage ways. The walls between the classes and those in the passageways are to be rock wall plaster on metal lath.

Entrances to the residences and to the school are on Rielle and Willibrords Streets, the boys and girls having separate entrances.

Four structural iron fire escapes will be installed at the rear of the school, with exits from each floor to the fire-escapes. This will give ample accommodation in case of fire.

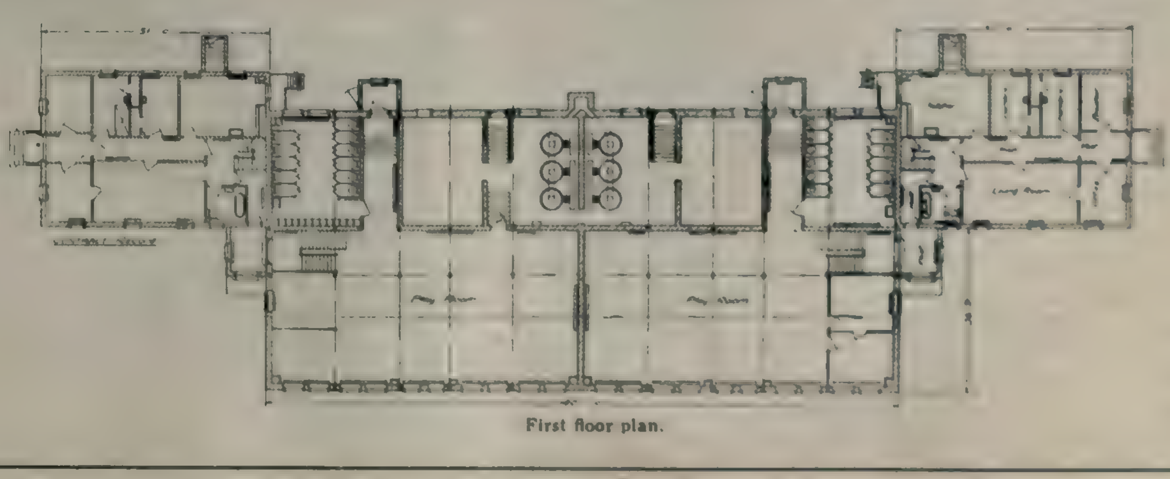
The roof is covered with a Barrett Standard Specification, pitch and gravel roof. It is pitched to the centre of each section of the building and the down pipe hoppers are protected with copper rat trap screens. The flashing is Queen's Head galvanized type and it is carried well up the inside of the parapet and fire walls. Four large, modern type of revolving ventilators, two for each section, are installed. Their capacity is sufficient to assure good ventilation.

Type the Signatures to Letters

CERTAIN manufacturers, in their correspondence, have adopted the practice of having the name of the writer typewritten, and then signed in the usual way.

Business firms generally must find it difficult to decipher a written signature on many letters, and should join in eliminating an annoyance which is very irritating.

It is realized, we are sure, that names are often hard to decipher, and the fact that a reply to a letter contains at the top a mis-spelled name, is not always due to carelessness, inexperience or stupidity. Let us make it a common practice to typewrite the signature in addition to the usual method of signing it.



First floor plan.

Cementation Processes of Francois and Portier

By A. H. Krynauw*

DURING recent years experience has proved that cement can be introduced, under pressure, into the minutest fissures and cracks in rock strata, as well as cracks and interstices in masonry and concrete constructions, and made to set there. (An example of this practice was described in an article on the Dam at Paris, Ont., for Penmans Limited, in our issue of September the 11th, 1918.) This practice of introducing cement grout under pressure has evolved to that known to-day as the Francois cementation process. An essential condition in the introduction of cement into fissures and cracks is that the injection should be done under a considerable pressure, the object being, firstly, to overcome the contra pressure of water present in the fissure; secondly, for the purpose of forcing the cement as far as possible into the minute cracks; and, thirdly, for the purpose of squeezing out the superfluous water from the cavity which is being filled with cement pulp, and thus leave the cement in a condition most suitable for its rapid and efficient setting.

Cement milk, when allowed to set ordinarily under water, does so only very slowly and reluctantly, but when the same milk is subjected to pressure, such as produced by a specially constructed cementation pump, the cement sets hard within 24 hours. The setting of cement is chiefly due to the inter-crystallization of hydrated calcic silicate and hydrated calcic aluminate, just the necessary amount of water being taken up to complete the crystallization; the crystals grow together and form a hard mass. Now, when a superabundance of water is present, such as in the mixture used in cementation work, these crystals ordinarily seem reluctant to inter-crystallize; consequently, the setting of the cement is very slow and incomplete. The condition most suitable for hard setting in the shortest time, when the cement is pumped under pressure into fissures, etc., appears to be somewhat as follows: First of all, the constricted exits of the fissures are choked with cement pulp, which forms a filter bed on which successive layers of cement are deposited, the surplus water being squeezed out through the cement filter already formed in the peripheral areas of the fissure or cavity. As more cement solution is injected the pressure gradually rises and goes on rising, owing to the fact of the water having to be squeezed through an increasing thickness of cement filter. The successive layers of cement eventually fill the fissure or cavity completely, leaving the cement in a condition suitable for complete and good setting. Pressures of 1,000 to 4,000 lbs. per square inch are used, and for this purpose a specially designed pump is employed, of the double ram horizontal type with a 12-inch stroke, the steam end having a diameter of 14 inches and the water end a plunger diameter of 1⅝ to 3 inches, depending on the final pressure likely to be required. As the wear on the valves is great, hardened steel balls are used.

In the following cases cementation has been successfully applied:

1. In greatly minimizing water difficulties in shaft sinking or tunnelling through water-bearing strata, faults and dikes.
2. In sealing and rendering water-tight the concrete tubbing or lining often used in circular shafts.
3. In sealing open fissures through which water is flowing.
4. In damming back water leaking through broken ground, in the vicinity of faults and dikes.
5. In rendering underground dams water-tight.
6. In rectifying defective boreholes.
7. In rendering impervious the foundations of surface dams or making solid the rock and concrete foundations of engines, etc.

The process as applied to shaft sinking consists of a treatment of the strata, through which the shaft is to be sunk, with cement grout, which is injected into the fissures and cracks of the rock mass, thus sealing them and rendering the ground practically free of water. The method of carrying out the work is as follows: A system of drill holes is put down on the periphery of the shaft, and through these holes a thin cement mixture is introduced, which finds its way into the cracks and crevices, rendering them impervious to water. There are two methods of carrying this out. In the Portier method the holes are put outside the perimeter of the shaft, and it is claimed that this has the advantage of permitting the sinking of the shaft simultaneously with the injection of the cement. This is a very strong point, in that it practically overcomes the interruption and delay to the sinking of the shaft while conducting the process. On the other hand, the Portier system is attended by the following disadvantages:

(a) The possible deflection of the boreholes into the shaft, rendering them useless for the subsequent injection of cement.

(b) The danger to sinkers, when applying great pressure in the boreholes, owing to the possibility of rupturing the sides of the shaft.

(c) The boreholes may intercept several fissures, but the mouth of the hole being above the water level, it is not possible to tell which fissure is the chief water carrier, so that when injection takes place the tendency will be for the cement to take the course of least resistance into the larger fissures, while the smaller ones, though probably of considerable importance, are only sealed in the vicinity of the hole itself.

In the Francois system the boreholes through which the cement is introduced are put down, within the limit of the shaft, arranged on the perimeter at various distances apart, depending on the size of the shaft and thickness of rock strata to be treated. The detailed method of procedure is indicated by the following description of the work being done at the Daggafontein and Brakpan mines:

Daggafontein No. 2 shaft is a 7-compartment rectangular shaft, 49 ft. long by 9 ft. wide, and was sunk from the surface to 175 ft. in dwyka conglomerate containing numerous cavities and fissures, giving a fair amount of water, but not of such quantity as to seriously hinder sinking. At a depth of 354 ft. the syenite dike of the far East Rand was encountered, and the shaft sunk in it to its present depth of 500 ft. At this stage the water dealt with amounted to 21,000 gallons per hour, and the management decided to put down a pilot borehole to ascertain the nature of the strata ahead. This hole intercepted the dolomite series at a depth of 12 ft. below the shaft bottom, and at a depth of 165 ft. a considerable amount of water was encountered. In view of the probability of large quantities of water being met with in the dolomites, shaft sinking was stopped, and the adoption of the Francois cementation process decided upon. From the data available the thickness of the dolomite formation was estimated at 200 ft., the direction of the boreholes being set out accordingly, so as to permit of a single stage treatment for the full width of the strata. Unfortunately, the thickness of the dolomites proved to be considerably more than anticipated, being a total of 345 ft., which distance was considered too much for treatment in one stage. A distinct open parting exists at the contact of the syenite dike and underlying dolomite. This was clearly demonstrated, for when drilling through the dolomite contact the feed water was forced out of holes previously drilled. At a depth of 35 ft. the first feeder was met with containing sufficient water to cause a flow of 250 gallons per hour out of a 1½-inch drill hole. A second and larger fissure was struck at a depth of about 130 ft., and as each hole intercepted water, cement grout was injected, the progress of the inspection being observed by the rise in pressure indicated on a pressure gauge. When a pressure of 2,000 lbs. per square inch was reached, pumping was stopped and the cement allowed to set. In all 55 tons of cement were used, and as the depth of the holes is about 180 ft., sinking can now be continued for that depth.

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* From paper submitted to the monthly meeting of the Chemical Metallurgical and Mining Society.

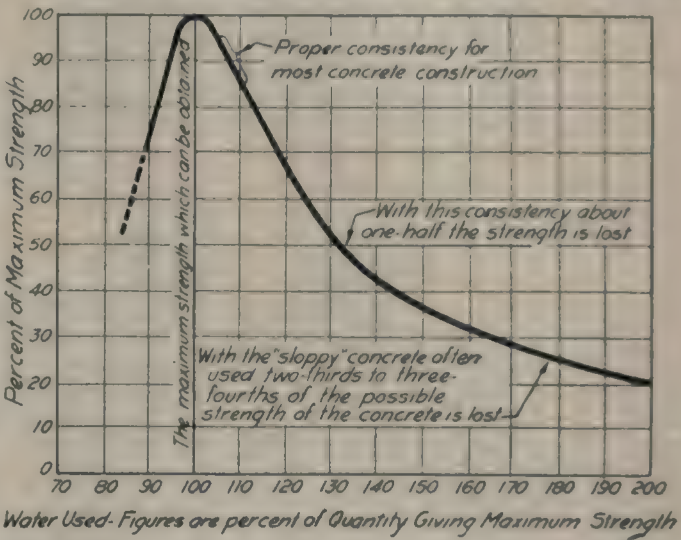
BUY VICTORY BONDS
You are merely asked to LEND your money at a good rate of interest—on rock-bottom security. Compare this with what the boys are GIVING.

Effect of Water on Strength of Concrete

FOR some time experiments have been in progress at the Structural Materials Research Laboratory, Lewis Institute, Chicago, to determine the effect of various quantities of water on the strength of concrete. These experiments have been directed by Duff A. Abrams, Professor in Charge of the Structural Materials Research Laboratory.

Prof. Abrams has reduced his experiments to an intelligible form, which is interpreted by the diagram. This summarizes the results of compression tests on 6 by 12-inch concrete cylinders made in mixes ranging from 1 part cement and 9 parts aggregate, to 1 part cement and 2 parts aggregate, by volume. These mixes represent concretes of all qualities from the leanest to the richest which are generally used for any purpose. The aggregate consisted of a mixture of sand and pebbles graded in size from the finest particles up to 1¼ inch. Exactly the same grading was used in all cases.

These tests show that the effect of proportional changes in the mixing water is approximately the same for all mixes of concrete, consequently a composite curve has been drawn to show the average effect. The vertical distances represent the relative strength of concrete, expressed as a per cent. of the maximum which can be secured from a given amount of cement and the same aggregates. The horizontal distances indicate the relative quantity of water used in the mix, considering the amount which gives the maximum strength as 100 per cent.



The amount of water which gives the maximum strength in concrete produces a mix which is too stiff for most purposes. In plants where such products as building units, drain tile, sewer pipe, etc., are manufactured it is desirable to use a mix even drier than that which gives the maximum strength. The molds can thus be removed within a short time; this would be impossible if a wetter and more plastic mix were used.

It will be noted that the concrete strength increases rapidly with the quantity of water over the range indicated on the diagram. With any further increase in the amount of water there is a rapid falling off in strength, as indicated by the curve. With an amount of water about double that required for highest strength, the concrete has only about 20 per cent. of the maximum strength.

The exact amount of water corresponding to the maximum strength of concrete will vary with the method of handling and placing the concrete. Any method which involves puddling, tamping, rolling or vibration, or the exertion of pressure in any manner, will have a tendency to increase the strength of the concrete regardless of the amount of water used. However, it is probable that the effect produced by these methods will be more pronounced in the consistencies in the vicinity of the maximum strength.

BUY VICTORY BONDS
Are you SUBSCRIBING the way they are FIGHTING?

Better System of Highway Cost Keeping

By James J. Tobin and A. R. Losh*

THE purpose of this paper is to present, first, in an elementary way the principles which govern cost keeping; second, a practicable application of those principles to highway work. The term "cost," as generally interpreted and as used in this bulletin, is the summation of expenditures expressed in terms of money involved to acquire or produce a utility or to perform a service.

The cost of every unit of product, whether it be a square yard of road surface maintained, or a cubic yard of concrete which is a part of a bridge or culvert, is composed of four basic elements of expense, namely:

(1) The cost of labor.
(2) The cost of materials.
(3) The cost of service of plant and equipment.
(4) The cost of general expense or overhead.

Labor

The costs of labor are divided into two classes; first, direct labor cost; and, second, indirect labor cost. All labor chargeable against the product which can be designated as directly expended on it is called direct labor. All labor chargeable against production and not directly expended on the product is called indirect labor. For example, the cost of men using picks and shovels on excavation who are directly expending their efforts on that piece of work is a direct labor charge. A superintendent in charge of a road job is not directly expending labor on excavation, but is engaged in directing the prosecution of all kinds of work and his expense is an indirect labor charge, chargeable pro rata against the production of all the work units he may be supervising. Other examples of indirect labor are the services of watchmen, timekeepers, and water boys.

MATERIALS

Materials also are divided into two similar classes —direct and indirect. All materials entering the product as an integral part of its composition are called direct materials. All materials chargeable against the production but which do not enter directly into the product as an integral part of it are called indirect or expense materials or sometimes supplies. The cement, stone, and sand that are mixed together to form the concrete of which a concrete road is constructed are all direct materials, but the oil used for lubricating and the gasoline for operating the mixer in which these materials are prepared for use are indirect materials or supplies. It is easy to charge direct material cost, but often it is very difficult to charge to each product its correct share of indirect material cost.

Small, or hand, tools not used as a part of some plant unit and which have such a short period of usefulness that they are seldom used on more than one job, usually are considered supplies and therefore are part of the indirect materials charged to the work.

PLANT AND EQUIPMENT

"Plant" includes such physical property used on the work as land, structures, machinery, live stock, and tools of a more permanent character than those referred to as supplies. "Equipment" is a less inclusive term and is interpreted generally to mean the smaller and especially the movable plant units. The cost of the service of "plant" can be charged most readily in the form of a daily rental against the work upon which it is used. This rental should be charged whether the equipment be owned by the operating organization or leased from the owners. It consists of "operating charges," which are—

(a) The expense of operation,
(b) The average cost of repairs,
(c) Charges for the time spent in idleness,

and "fixed charges," which are—

(d) Charges for depreciation,
(e) Interest,
(f) Taxes,
(g) Insurance.

The Expense of Operation

This includes the wages of operators and helpers and the cost of supplies during the periods of operation. Usually these are charged directly against the work done and not included in the plant rental. It is only necessary that they be charged in one place or the other, and it is important to specify what is included in rental when leasing equipment.

The Average Cost of Repairs

There is a difference of opinion among cost accountants as to how repairs and renewals to plant should be charged. One view is that renewals may be of such a nature that the useful life of the machine has been increased and therefore the expense of such renewals should be looked upon as an offset to depreciation. Another view is that there is no difference between repairs and renewals, except in degree, and that they all should be considered in the same light, i.e., independent of depreciation charges. It appears that the latter consideration permits simpler accounting and does not rely so much upon individual judgment as to whether the expenditure is for repairs or for renewals.

After a machine has been rebuilt or repaired extensively with the intention of increasing its serviceable life, it should be considered as a piece of new equipment valued at its depreciated value, plus the cost of renewals. This necessitates the computing of a new rate of depreciation on the basis of the new value and assumed new useful life.

The approximate average cost of repairs, including extraordinary repairs, often can be arrived at by casting up old accounts and finding what a similar piece of machinery used on similar work has cost for repairs over a term of years.

Charges for Time Spent in Idleness

To arrive at a fair and equitable daily charge for rental some allowance must be made for time spent in idleness, because on these days the fixed charges still are continuing and certain supplies are necessary even though the machine be not in operation. The usual way of arriving at the charge for lost time through idleness is to bring together all of the charges for a year and divide them by the number of days the machine actually was in use. By dividing the sum total of expense by the number of days the machine was available for use even though no work existed on which it could be used, the result would be a daily rental with no allowance for lost time. The difference between these two rentals will show what a considerable factor in the fixed charges this item of lost time may become. In all contracts or agreements on rental of equipment care should be taken to specify whether the rental is "per day" or "per day of service."

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*U.S. Engineer Economists

Equipment is consumed in production just as truly as material. This loss is called natural depreciation. Depreciation may be either natural or functional. All equipment progresses steadily toward the scrap pile, starting the date it is purchased, and while its progress may be delayed it can not be prevented by repairs. It is as much an expense on a steam roller as the cost of fuel burned in the fire box. In the case of fuel the expense is immediate; in the case of depreciation the expense is extended over a period of time. Functional depreciation is loss due to the obsolescence or inadequacy of equipment.

There is no doubt in the minds of cost accountants that depreciation of plant and equipment should be included as a charge against operation, but there is considerable difference of opinion as to how depreciation should be computed.

Three factors determine in all cases what the depreciation should be: First, the original cost; second, the length of useful life; and third, the scrap value of the machine when it no longer can be used for the purpose for which it was purchased, or the salvage value, if it is to be considered as a "second-hand" piece of equipment. Knowing these factors, the problem resolves itself into how to divide the difference between the original cost and the scrap or salvage value (called total depreciation or wearing value) over the length of the useful life of the machine. A number of formulas have been devised for computing decreases in value or depreciation. Fish, in his text-book on "Engineering Economics," explains five such formulas. Three of the more commonly used are the straight line, the declining balance, and the sinking fund.

The first is recommended as the simplest and perhaps best method for road work. By this method the total depreciation is divided by the number of years of useful life and the quotient charged off as a yearly depreciation. This is called the straight-line method, and its greatest advantage is its extreme simplicity.

The second method, a modification of the straight-line method, is called the declining balance method. It is based on the theory that during the earlier years of the life of any machine the repairs are smallest, and therefore to arrive at a constant charge for repairs and depreciation, the depreciation must be heaviest in the earlier years of the life of the machine and lightest in the last. The plan, therefore, is to charge off a fixed percentage annually from the net value of the machine. This gives a diminishing annual charge for depreciation. In the comparative table herewith this annual rate is about 30 per cent. This is determined by the formula

$$r = 1 - \sqrt[n]{v_2/v_1}$$

in which r is the percentage of diminishing value, n the life of the equipment in years, v_1 the original value and v_2 the scrap value.

The third method is called the sinking-fund method. It is based on the assumption that the depreciation on a structure at any time is equal to the accumulations of a sinking fund established for renewal at the end of its useful life. The depreciated value plus this sinking fund (actual or imaginary) at any period equals the original cost.

It should be observed that none of these formulas takes into consideration interest on investment, output, cost of operation, or maintenance charges. Fig. 1 gives a graphic comparison of the above formulas.

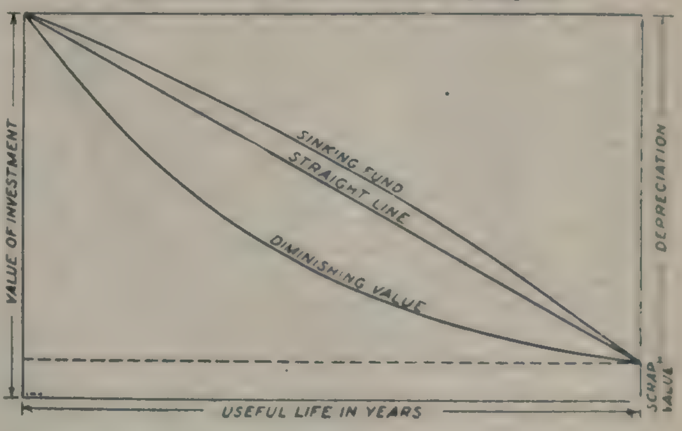
The following table is a comparison of the annual depreciation on a $600 machine that has an assumed useful life of five years. It also is assumed that at the end of this period it will have a scrap value of $100. The annual depreciation is computed by the three formulas described:

Comparison of three methods of computing depreciation.

Years	Straight-line method.	Diminishing value method.	Sinking fund method 6 per cent interest.
First....	$100	$180.72	$88.70
Second	100	126.28	94.02
Third	100	88.25	99.66
Fourth	100	61.67	105.64
Fifth	100	43.08	119.98
Total	500	500.00	500.00

The theory of natural depreciation, epitomized, is that all equipment, even if kept in the best of repair, in time will reach a state where repairs no longer are sufficient to keep it in economical working condition and the entire machine must be renewed. The fund created by the depreciation charges is intended to supply the money to purchase a new machine to take the place of the one expended, or to retire the original investment in case the machine no longer is needed.

COMPARISON OF DEPRECIATION FORMULAS



Any of the depreciation formulas is satisfactory in determining rental charges, provided the assumed life of the machine be approximately correct. As the assumption of the useful life of the machine may be the source of considerable error, there seems to be little argument for the finer calculations as to methods of distributing the depreciation.

It will be found convenient in computing depreciation to group elements of the plant having approximately the same serviceable life. This will have the advantages of requiring fewer accounts and tending to equalize high and low assumed machine life.

Repairs and renewals are charges due to breakage or the wearing out of expendable parts of equipment. It is obviously incorrect to charge to repairs or renewals any improvements or betterments added to any piece of equipment. When such improvements have been made the cost should be added to the present value of the machine and a new depreciation computed upon this new value. An example of such a case would be the addition of a conveyor to an old stone crusher for the purpose of doing away with shovelers. The improvement is not a repair of any broken parts or a renewal of any part worn out by the continual use of the machine; it is a new feature which adds to the value of the crusher. A rebuilt second-hand machine may be considered in the same light.

Interest, Taxes, and Insurance

Interest should be charged on the investment at the rate paid or the prevailing rate, where there is no indebtedness.

Taxes, as paid, should be charged in the rental rate.

Insurance should be charged either as paid or at the prevailing rates if the organization carries its own risk.

GENERAL EXPENSES

The fourth element of cost is general expense. It often is called "overhead" or "burden," terms derived from factory cost keeping, the use of which in highway-cost keeping is not recommended.

General expense includes all charges that can not be connected directly with the cost of labor, material, and plant. For convenience in accounting and for the purpose of securing a desirable division of road cost, general expense will be considered as divided into two classes. One will be referred to as "engineering and supervision" and will include those items of inspection and engineering which can be charged directly to the project. The other class will be referred to as "administration expense" and include those expenditures incurred in conducting all the activities of the department which are so general in character that they are not assignable directly to any particular project.

The desirability of separating the project cost of engineering and supervision from administration cost and unit costs will be apparent after a little consideration. The work of the engineer in preparing the plans and specifications affects labor and material costs only in the kinds and amounts that may be required and not at all in the efficiency of their expenditure. By carefully worked out profiles and cross-sections an engineer may reduce the yardage of excavation required, but such planning may not reduce the cost per unit of excavation. To secure efficiency in operations is the function of the superintendent or the foreman who is responsible for the cost of such operations. If engineering and supervision cost is incorporated in unit cost, an element is included over which the foreman or superintendent has no control, and his efficiency is obscured thereby. If, on the other hand, engineering and supervision cost is included in the charge of administration, it is placed in a class of expenditures over which the engineer has little or no control.

Highway administrative organizations are prescribed largely by statute and the attendant costs necessarily are dependent, in a large measure, upon the form of the organization, the various duties required, the methods of financing, and many other factors, all of which are conditions imposed by legislation. To include with these administrative costs the cost of project engineering and supervision would mean the loss of valuable comparable information on the efficiency of the divisions of an organization and one type of administrational organization with another.

Administration

Administration costs include such expenditures as salaries and expenses of the executive officers, legal services, maintenance of office, departmental engineering, investigations, experiments, clerical staff, fiscal operations, and miscellaneous fixed charges. These expenditures can not be allocated directly to any particular class of work or to individual projects.

Cost accountants have devised numerous ways of distributing general expenses to the various classes of work. Most of these, however, are not practicable in the distribution of such expenses on road work. Since indirect labor and indirect materials are distributed directly in the unit costs, and engineering and supervision are chargeable directly to projects, the remaining portion of what would be considered "burden" by factory accountants is comparatively small in proportion to the aggregate expenses. Any portion of general expense that can be assigned directly to a project should be charged against such project. The remainder should be prorated over all the project expenditures for the period.

Engineering and Supervision

To engineering and supervision should be charged all expenditures for surveys, plans, specifications, estimates, tests, and all engineering inspection and supervision in the nature of oversight required to secure the proper execution of the work. Such expenditures can be charged directly to individual projects.

FIXED CHARGES

Fixed charges are those items of expense which go on practically unchanged irrespective of the activities of the organization. Those fixed charges which pertain to the production plant have been discussed in relation to plant and equipment. Certain fixed charges not immediately connected with production operations may best be considered as a part of general expense. Thus depreciation, interest, taxes, and insurance are elements of expense also in relation to the plant and equipment of the administrative organization, such as buildings, office and laboratory equipment, instruments, machines, and similar items.

In the practical application of cost keeping, fixed charges are considered only insofar as they aid in the determination of efficiency, and their inclusion as an item of cost in a question of accounting. Where fixed charges result from methods of financing rather than the methods of doing the work they belong to the field of bookkeeping and not cost keeping. Thus, where a county issues bonds for road improvement the interest is a fixed charge which must be paid and so increases the total outlay for the improvement, but has no relation to the efficiency with which the work is executed, and is, therefore, a matter of bookkeeping and not cost keeping. Where two crews are engaged in excavation, one with power tools and the other with hand tools, fixed charges are of prime importance to the cost keeper for the purpose of determining efficiency and the cost of operation in each case.

It is customary among contractors to include all fixed charges as a part of the expense of work, and therefore they appear in the unit prices of their itemized bids. In making up his estimates on unit prices to check against submitted bids, the engineer therefore should include among other fixed charges interest on capital invested in plant and on necessary operating capital, for materials, pay roll, and deferred payments.

Considerations of fixed charges are also important in the selecting of equipment and determining upon types of improvements. These considerations are, however, within the fields of engineering economics and not cost keeping, although cost data have a most important part in the final determination.

HIGHWAY COST ANALYSIS

An analytical chart has been prepared to place before the reader in concise and convenient form a summary of the foregoing discussion of cost elements applied to road work, and to show the relation between the cost elements and the final cost of the project as expressed in totals and by units. The first column of the chart contains the four basic elements of cost. Opposite each element, in the second column, are the classes of expenditure, such as direct, indirect, etc. The third column shows in detail the specific application of the cost. Example, "for materials," "for labor," "superintendence," etc. The fourth column contains a tabulation of the class of product resulting from the cost outlay, such, for example, as construction, maintenance, right of way, etc. The fifth column contains the final cost and presents it by units, by project, etc.

	Elements of cost	Classes of cost.	Application of cost.	Product of cost.	Summary of cost.
Highway cost....	Labor cost..	Direct	Wages of laborers, mechanics, teamsters, etc.	Construction, maintenance, or reconstruction of road parts, right of way, grade and roadside, roadway, ditches, drains, bridges, and culverts, and supplementary parts.	By units, direct, as performed.
		Indirect ..	Wages and expenses of superintendents, foremen, timekeepers, guards, watchmen, water boys, etc., lost labor days, labor expense.		
	Material cost...	Direct.....	Materials entering into product as integral parts.		
		Indirect ..	Supplies, used but not as a part of product.		
	Plant and equipment service cost.	Operating	Operation. Repairs. Idleness.		
		Fixed.....	Depreciation. Interest. Taxes. Insurance.		
	General expense cost.	Project: Engineering and supervision.	Salaries and expenses of engineers, field parties, draftsmen, inspectors, and clerks, office expenses, tests, and miscellaneous expenses for individual projects.	Plans, specifications, estimates, surveys, inspection, and direct supervision of work.	By project; upon completion may be apportioned to units.
		General: Administration.	Salaries and expenses of executive, engineering, legal, and clerical staffs expense of office maintenance, experiments, investigations, and fiscal operations, miscellaneous fixed charges.	General direction, policy, oversight, planning, control, legal, and financial provisions.	On all operations over a period of time and apportioned to projects.

UNITS OF MEASUREMENT

Care should be taken in selecting the units on which to collect cost data. Too many and varied units will make the system cumbersome and expensive, while too few may impair its value seriously. Furthermore, the units of measurement adopted for any cost-keeping system or project must be definite, expressive, readily obtainable, and familiar. Thus, for example, the ton and the cubic yard as applied to broken stone are definite units and afford a ready and accurate comparison, but the square yard when applied to a finished macadam road is indefinite until additional information as to the depth of the material is available. Similarly, many units, such as wheelbarrow, wagon, truck, or carload, while often convenient units of count in the field, are indefinite and always should be reduced to definite comparable units, such as cubic yard or ton.

The units selected must, so far as possible, be expressive of definite operations. Thus, while in engineering construction the cubic yard is a very common unit upon which contract prices are based, it frequently is a very uncertain unit of performance, as it is a composite of other units. For example, in rock excavation there are involved the following operations: (1) Drilling, (2) blasting, (3) breaking large chunks, (4) loading into carts, wagons, cars, or the like, (5) transporting, (6) dumping.

The important item of drilling depends largely on the necessary spacing of the drill holes, which varies in the different kinds of rock and in different kinds of excavation. Clearly, then, the linear foot of drill holes is the unit for measuring the output of the drillers, and not the cubic yard. Transporting the rock is largely a function of distance; hence the unit of transportation cost should be the ton or yard carried 100 feet or 1 mile, and not the cubic yard without the factor of distance.

The units must be obtainable readily or the cost of collecting the necessary data will be too high. Thus, for example, to obtain the exact cubic yardage and the distance it was moved in preparing the subgrade for a macadam road with a road machine would be not only difficult, but expensive. Hence for this class of work the readily obtainable, though less definite, unit of the square yard usually is adopted.

That the full value of the cost-keeping system may be realized, the units in which the data are expressed must be familiar to those charged with their collection as well as to those who are to profit from their use. Thus, the cubic meter is as definite a unit for measuring earthwork and generally as readily obtainable as the cubic yard, but to the average roadman it has little or no meaning until translated into the terms in which he is accustomed to think. If any one of two or more units otherwise would answer equally well, the one most familiar and generally used always should be adopted.

There are many units so closely related to the desired unit of measurement that with very little computation they can be transformed into the desired unit. For example, the knowledge of the mixture of the concrete are functions which at once determine the amount of sand and stone used.

Montreal Builders Discuss Conference Plans

At a special meeting of the Montreal Builders' Exchange, the subjects of labor conditions and workmen's compensation were considered. Mr. J. P. Anglin, who presided, referred to the unsettled condition of the building trade, due to the war, and suggested that work might be done on parallel lines to that of the recently formed National Federation of Building Industries, Philadelphia.

Mr. W. E. Ramsay, in pointing out that the interests of general contractors, sub-contractors and supply men were practically identical, said that the watchword should be co-operation, co-ordination, and liberality with one another.

On the subject of female labor, the president stated that the directors of the Exchange recommended that this be brought before the conference to be held in Ottawa on November 26, 27 and 28.

Mr. Irving was of the opinion that the entire labor situation should be discussed and he hoped that some plan would be evolved in the direction of making labor more efficient.

The following committee was appointed to draft a resolution on the subject to be submitted to the Ottawa conference—Messrs. Irving, Munn, Locker and Fussing. The same committee will take steps to submit the subject of workmen's compensation to the conference, with a view to having the various compensation acts throughout the Dominion made uniform in their operation, so that contractors competing from different provinces would be on the same level. Twelve hundred invitations to the Ottawa conference have been sent out.

The Kaiser is Watching You—Disappoint him.

Essentials of Proper Construction

By J. W. Rollins*

SUBMERGED concrete structures are chiefly bridge piers, wall footings, foundations, lock or dock work, or are of similar character, generally involving large quantities of mass concrete usually without reinforcement. It is mostly placed in large, simple forms without complicated or delicate parts and does not require special finish or extreme accuracy of position or dimension.

Such concrete is ordinarily required principally to have mass, weight, stability, and compressive strength and to have uniform good quality, solidity, and to be continuous and reliable. It is not often required to have special properties for resisting the action of fresh or salt water, waves, tidal action, or river currents. If exposed to impact and abrasion by floating bodies it may be protected by breakwaters, wood sheathing, or other devices. On pier work it is desirable to face the concrete with cut stone from a distance of two or three feet below low water to as great a height above high water. This is desirable not only as a protection against ice and drift but to avoid the possibility, which can never be wholly eliminated, of disintegration of the concrete. The physical properties and the methods of mixing and handling submerged concrete do not differ from those suitable for other forms of mass concrete except that it is necessary to provide methods of placing it that will prevent the cement from being washed out before the concrete sets, to preserve its integrity while soft, and to be sure that it is properly placed, completely filling the forms, and making a solid mass by the use of regular methods that give reliable results even for operations that are conducted out of sight. When concrete is properly deposited under water through a tremie or a bottom-dump bucket protected by cofferdam or caisson walls, there is little reason to fear washing of the cement. The actual cost of mixing and placing submerged concrete, aside from the construction of forms, cofferdams, tremies, and special plant, is no greater than that of mixing and depositing concrete above water.

Structures that are to be submerged in service may sometimes be built in the dry or partly in the dry, as when they are built in cofferdams that are completely unwatered before concreting is commenced or completed, in which case ordinary land methods are followed. In other cases the structures may be built in cofferdams which are not completely unwatered and a considerable quantity of concrete may be deposited in them under water, thus sealing the cofferdam and forming a watertight bottom permitting the subsequent unwatering of the cofferdam and the placing of the rest of the concrete by ordinary methods. Another method which has recently been greatly improved is for the construction of piers and similar structures in floating cofferdams where the concrete is protected from the water, although sunk far below its level to final position on the previously-prepared foundation. There are also structures that are wholly concreted in the water, involving various methods for handling and depositing the concrete, some of which correspond with those used in cofferdam work.

Concrete that is to be deposited in the water before it sets should never be mixed leaner than 1:2:4. It should have a mushy consistency intermediate between that of the old-fashioned dry concrete that required heavy tamping to flush it and the ordinary wet concrete that is made thin for spouting. Gravel is a much more satisfactory aggregate for it than is crushed stone. particularly when it is placed with a tremie, because the rounded corners of the pebbles make for easy flowing and diminish the friction and the liability of choking.

The location and arrangement of the mixing plant and the method of handling the concrete from the mixer depend on circumstances, particularly the facilities for delivering aggregate, whether by land or water. If by water, as for an ordinary job of bridge piers, seawall, or the like, a floating plant is generally more satisfactory on account of the facility of unloading the sand, gravel, and cement barges and the ease and rapidity with which the whole plant can be moved to deliver concrete to successive units of the structure. The floating plant can also be transferred from job to job in the same locality or can even be moved a long distance in the open sea with remarkable safety and economy and does not require loading and unloading on railway cars or trucking from place to place.

On the contrary, when materials are delivered by rail or trucks, or where the water is very shallow or an existing bridge or viaduct affords transportation facilities there are occasions where materials can be most conveniently and economically handled by a service track alongside the work and the mixing plant may either be built on piles or falsework at some point of this track or may be installed on shore and delivered to cars on the track or in some cases to long-span cableways carrying large concrete buckets to different parts of the work. In most cases, whatever type of general distribution is selected, the final delivery of the concrete buckets to the forms is generally most satisfactorily effected by a simple derrick system unless conditions are such as to favor spouting from hoisting towers.

Foundations

Concrete for the foundations or footings of submerged structures may be placed in large mases directly on the bottom of the excavation or in direct contact with sand, gravel, hardpan, or rock, or it may be placed on special foundations, such as piles or grillages, or the concrete may be used to level up the irregular bottom or to furnish continuous bearing for another part of the structure or to fill cavities and close leaks in cribs or cofferdams. If a large amount is deposited it should be deposited in a continuous layer 2 or 3-inch thickness extended back and forth over the entire area with considerable uniformity.

When an irregular surface is to be leveled up to receive a superstructure or provide accurate bearing for timber or masonry, it may be necessary to level the surface of the concrete with a screed or drag or by a straightedge moving on templates handled or inspected by a diver. A diver may also be required to fill small cavities or stop leaks around the cribs or cofferdams or sheeting and he may build up footings or close openings advantageously by the use of concrete made not leaner than 1:2:3 and filled in burlap bags of about

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*In "Contracting"

3 cubic feet capacity, carefully set in position. These bags can be laid up like rubble masonry and are so plastic that they pack together into a solid mass with few or no interstices and these quickly filled by the mortar that exudes through the minute openings in the cloth, making a practically watertight mass in which the burlap forms a permanent reticulated fabric. Work of this nature can be done so well that if blasted after it has set, the mass will break through the bags rather than between them. Foundations of this sort have been extensively and satisfactorily used to make footings on the sloping surface of irregular rock bottom for huge concrete blocks in the seawalls built by the Department of Docks, New York City. The use of concrete in paper bags for similar purposes has been proposed, but is objectionable on account of the danger that the paper would not fully dissolve and might produce injurious laminations in the concrete and also prevent the thorough distribution of the mortar to fill interstices and make a solid mass.

Bottom-Dump Buckets

Concrete cannot be successfully dumped into the water from a point above the surface, nor can it be deposited below the surface in an ordinary tilting bucket with good results since the combined action of the water and of gravity will quickly separate the coarse and fine material and wash away the cement, making a very poor and unreliable mass that may often be little more than irregular layers and pockets of sand and gravel.

The oldest and commonest way of depositing concrete under water is by means of a bottom-dumping bucket which, if properly constructed and operated ,can give good results under widely differing conditions, particularly in comparatively small areas. This method is in almost universal use for various purposes, especially for filling pockets and dredge-wells in cribs. The walls of the buckets generally extend vertically below the closed bottom and should always be designed so that the buckets may be firmly seated while the doors are closed and that opening them may permit the concrete to descend and spread laterally by gravity as the bucket is released and is hoisted clear of the concrete. The buckets should be automatic so that as soon as they are supported on the bottom and tension on the hoist line is released they will open of themselves and permit the concrete to flow out and take its natural level.

For submerged concreting it is important that the buckets should be open at the top since this does not cause any injurious washing and does prevent the tendency that exists for the formation of a partial vacuum when the concrete is discharged if the top is tightly closed. This vacuum interferes with the rapid emptying of the bucket and if the top is closed the weight of the concrete in the partly-emptied bucket will eventually become less than the exterior hydrostatic pressure causing the water to be forced up through the concrete remaining in the bottom of the bucket and thus washing and seriously injuring it.

This action was conclusively demonstrated by experiments made in Boston to determine the proper kind of bucket to be used for depositing concrete for the thin facing of a wooden crib pier. When a bucket with a closed top was used to place concrete below the surface of the water in a large experimental tank, the concrete was entirely destroyed by washing and the material deposited formed loose strata of sand and gravel. When the top of the bucket was opened, no further difficulty was experienced and the concrete was found to be strong and uniform.

In depositing concrete under water it is essential to handle it in the largest possible masses and with the least possible exposure to the water. Bottom-flap buckets should therefore be made as large as the contractor's plant can fill and handle if the dimensions of the forms will permit. The size, of coures, depends on the conditions, character and dimensions of the work and may well be as great as 4 or 5 yards under suitable conditions.

Tremie Concreting

Where there is considerable lateral clearance and a large mass of concrete to be deposited under water, exceedingly good results can be attained by the use of a tremie properly designed and operated. To use this method successfully it is essential to provide and deliver concrete in sufficient quantities to keep the tremie used always filled and to handle it with such skill that the concrete is discharged from the bottom and distributed over the surface without being obstructed and without breaking the seal and permitting the water to enter the tremie.

In commencing operations the tremie is at first full of water and the concrete first deposited in it falls through the water and is washed, and must generally be allowed to escape. It is therefore of little worth until all the water has been expelled from the tremie and the bottom closed by the concrete, permitting the upper portion to be maintained full of good concrete that gradually escapes from the bottom of the tube, with little or no contact with the water until it spreads out on the surface.

In order to effect the proper distribution of concrete the tremie should be uninterruptedly moved back and forth horizontally, depositing a regular continuous course of concrete of uniform thickness without changing the elevation until the tremie's course is completed.

Whenever the tremie is raised at the end of a shift or on account of an obstacle there is danger of losing the charge which becomes a much more serious matter as the total mass of concrete increases, therefore for bridge piers and other structures having a horizontal area of less than 200 square feet where the difficulty of handling the tremie is increased and the effect of losing 2 or 3 yards of concrete is gravest, it is better to deposit the concrete with a bottom-dump bucket and to place it all in one continuous operation if the forms are strong enough to resist the pressure.

In large piers where concrete is deposited over a considerable horizontal area, the necessity of continuous work on a monolithic structure is less and there is little if any disadvantage in executing it with separate days' work even though they have irregular construction joints between them.

In tremie work it is very important to have a large tremie, easily and quickly handled, and to maintain an abundant supply of concrete under perfect control to secure regular operations and the best results. In many jobs the tremies are handled more or less carelessly by derricks or may even be shifted by hand, making it impossible to control them accurately and steadily and therefore difficult to maintain the seal at the bottom. A well-designed tremie plant properly installed and operated is capable, under favorable conditions, of placing concrete as well under water as it can be placed in the open.

An interesting example is that of the substructure for the Cambridge bridge across the Charles River, Boston. The concrete piers were of almost unprecedented size, some of them being as large as 62½ by 207 ft., with footings 30 ft. below high water level and a pile foundation enclosed by a cofferdam of 6-inch sheeting. The size and importance of the construction which involved placing thousands of yards of concrete under water, permitted the installation of an admirable system of concreting which was done with a conical tremie about 35 ft. long, made in sections 5 ft. long, connected through outside flange joints. The tremie, 18 inches in diameter at the top, and 24 inches at the bottom, was suspended from a hopper car of 6 yards capacity traveling from end to end of a transverse bridge that rolled on longitudinal tracks extending the full length of the cofferdam and thus commanding all parts of its area.

The hopper was kept constantly filled with concrete which was discharged through a bottom gate as the car was moved continuously on its bridge by a small engine. The concrete was deposited at the rate of about 40 yards per hour, thus placing one course of concrete the full width of the cofferdam in about 2 hours, and traveling the full length of the cofferdam in about two full 9-hour shifts on successive days. This resulted in the surface of each course presenting a series of transverse ridges or corrugations which were considered unobjectionable as they served to key successive courses together. All the concrete in each course was thoroughly bonded together as one transverse line did not set before the next was deposited in contact with it. In this case the concrete was so little impaired by the water that when the cofferdam was pumped out to an elevation of 6 feet below high level not a yard of laitance was discovered.

Laitance

When concrete is improperly deposited under water considerable difficulty and often serious damage is likely to result from the formation of laitance on top of successive courses of concrete. This prevents the bonding of the concrete, makes cavities and weak sections in the mass, impairs the integrity of the whole, and causes delay and expense for its removal.

If the concreting is interrupted more than a few hours or if it is washed soon after or during deposition, or if a disproportionate surface is exposed to the water, laitance is liable to accumulate in such quantity as to make necessary its removal by dredging, scraping, pumping, or other methods before additional concrete is placed.

When concreting is continuous except for cessation from night until next morning, and when the concrete is properly protected during deposition and comparatively small amount of laitance developed is so soft and thin that the heavier new concrete deposited when work is resumed forces it to the top, prevents it from being accumulated or retained in the interior of the mass, and permits it to be disregarded until the completion of the work, when the limited accumulations have all been forced to the top and may easily be removed at a single operation before or after unwatering.

In the case of a bridge pier where an 8 x 12-foot pocket about 130 feet deep was required to be filled up to a height of 80 feet by the tremie method, the lateral clearance was so small that it was necessary to raise the tremie instead of moving it transversely to discharge the concrete and it was very difficult to keep it filled with concrete. These conditions involved the accumulation of such a great quantity of laitance that when the work was completed it was 8 feet deep above the surface of the good portion of the concrete and was dredged out and removed in buckets at considerable expense.

Sinking Concrete in a Floating Cofferdam

In order to avoid depositing concrete under water the submerged footings of bridge piers have often been built on a permanent wooden grillage with detachable cofferdam sides forming a sort of boat moored in position above the prepared foundations. The concrete is deposited in the dry, filling the cofferdam or a form contained therein, and gradually sinking the cofferdam until at last the grillage attains permanent bearing on the foundation, after which the concrete is carried up above water level and the sides of the cofferdam or the form, or both, may be removed and the superstructure built in the ordinary way.

This method formerly involved the construction of a costly grillage consisting of several courses of heavy timber drift-bolted together and sunk to bearing on the leveled bottom or on submerged pile tops. On account of the expense, the difficulty of making the grillage watertight, and the lack of strength of a large grillage, the timber platform has recently been replaced by a special reinforced concrete platform of the same size, strengthened with longitudinal and transverse ribs or walls giving it any required degree of rigidity.

The exterior reinforcement ribs were arranged to make the walls of a shallow caisson deep enough to float. This caisson, built on shore, was launched like a scow and to it were attached sectional wooden cofferdam sides bolted together through their flanges and secured to the concrete slab by vertical sectional hook and screw bolts detachable from above. The joints were carefully caulked and no difficulty was experienced in keeping the interior dry while it was filled with concrete that eventually sank it to bearing on the pile foundation. As the cofferdam sank, the corner bolts through the walls were removed, becoming unnecessary as the unbalanced external water pressure held the wall panels firmly in contact. After the concrete was placed to about water level the large side panels were detached and removed for use on successive piers.

This method, which was applied to an important railroad bridge in Maine, was found very satisfactory and economical and not only saved a large amount of valuable timber that would otherwise have been used for the construction of the grillage but provided for uniform concrete construction of the pier down to the pile foundation and saved time and materials by using the cofferdam over and over again. Where conditions permit the application of this type of pier construction, it is likely to be much more desirable than depositing concrete by tremie or bucket under water and is cheaper and more rapid than the construction of sheet pile or crib cofferdams and then unwatering them and finally removing them.

Depositing Concrete on Pile Tops

When pier footings are concreted directly on pile tops without intervening grillages it is often possible to secure a better bond, a stronger pier, and more economical and rapid construction under favorable conditions than when the pier is supported on a grillage which cannot secure perfectly uniform and equal bearing on all of the piles. When the grillage is omitted and the concrete filled in directly on and around the pile tops it not only secures uniform bearing on them but is also supported on the bottom between the piles, thus utilizing the entire foundation area. In such cases the piles should not project more than 3 or 4 feet at the most, above the bottom of the concrete and it is better to drive piles in alternate rows and cut them off and then drive the remainder of the piles and cut them off about 2 feet higher, than it is to cut off all piles at the same elevation. The advantage of cutting off at two elevations is that it is much easier to cut them so than it is to cut them in the narrow space when they are all at the same elevation, and it is much easier to fill the spaces between the piles solid with concrete, besides which the staggered tops occurring in different planes weaken the concrete less than if they were all at the same level, thus diminishing the cross-section much more.

In designing detachable submerged concrete forms, as in designing the walls of detachable cofferdams, it is desirable to make them in sections or panels as large and solid as possible up to 15 or 20 tons, according to handling facilities. The courses should be generally from 15 to 20 feet high, bolted together successively through their flanges and the whole connected to the bottom by full-length hook bolts operated from above.

When a concrete pier does not have a pile foundation to anchor it and the lower part of it is deposited under water in a cofferdam the submerged concrete should fill the cofferdam up to about one-third of its height to give it sufficient weight to more than counterbalance the possible upward hydrostatic pressure when the cofferdam is pumped out. Otherwise there is danger that the bottom may be floated up and serious damage result when the cofferdam is unwatered.

Tile Pipe Versus Iron Pipe for Drains

By Osborne Smith, F.R.I.B.A., F.R. San. I.

It is a very sweeping statement to imply that anyone who suggests using tile pipe for drains inside a building knows nothing of sanitation.

Salt glazed vitrified socketted pipes have been used for many years and are still being used with perfect satisfaction in cities where modern sanitation is above reproach. The alignment of the pipes remains true, and they will hold up to the water test. Iron drains in these cities are the exception rather than the rule. The tile drains in these cities are preferable to the iron drains laid in some parts of Toronto, and similar cities.

The difference occurs principally in the methods adopted in laying the pipes.

No drain, whether of iron or of tile pipe, will remain efficient unless laid upon a solid foundation and with perfect joints.

To lay iron drains on bare ground and maintain a true invert is next to impossible, but to lay a tile drain thus is courting disaster.

It does not seem to be fully realized that a drain, especially when laid to a slight inclination, say 1 in 50 and less, must have a true invert, otherwise depressions will be formed which will retain sewage and water. As soon as a flow of water strikes one of these depressions its velocity is almost entirely checked so that the flow afterwards is due only to the inclination of the drain.

If a tile drain be truly laid on a bed of cement concrete and, after testing, banked on each side with the same material it will remain true to the grade specified. The concrete bed, or other solid foundation, not only maintains the grade of the drain, but it enables the workman to lay the pipe to the exact gradient required, which is not practicable by any other method. The banking up at the sides of the pipes not only strengthens the support, but protects the pipes and joints from injury.

The jointing of tile pipes is another point needing careful attention. The admixture of sand with the cement makes a porous joint, and is only used by unskilled persons who are unable to select the cement, at the right temperature, to prevent bursting of the collars. Oakum, too, is another expedient to assist in securing a true invert and to prevent cement squeezing into the inside of the pipe. Should the oakum project into the pipe it cannot be removed, and will cause obstructions. It also makes the pipe joint stand up to the water test even when the cement joint is defective. Oakum rots in time and leaves cavities in the drain for accumulation of filth, making the drain foul.

A well-made cement joint fills the entire annular space between the outside of the spigot of one pipe and the inside of the socket or hub of the other, as well as the space where the two pipes butt together. The joint should be finished off with a fillet of neat cement, as used for the joint, to an angle of 45 degrees to the side of the pipe, and well trowelled, special attention being given to the underside, where the leak, if any, will invariably be found.

The cleaning out of the cement, which exudes into the inside of the pipe, must be carefully performed. A close-fitting wad on the end of a cord is the best form of "badger" for this purpose. It is pulled forward as each joint is completed.

Slovenliness in laying drains, generally may be attributed to the absence of any ready means of access, after the trenches are filled in for examination or testing. Periodical tests and inspections would appear to be unknown. Anyone who gives any thought to the subject must admit that drains, like anything else, need attention from time to time, be they of iron or any other material.

A well-glazed tile drain does not corrode, and, when well laid and jointed, will be better than the cast iron soil pipe drain in general use, and would be less costly. The disadvantages of using tile pipe is the difficulty of securing competent pipe layers. The joints cannot be made where there is water in the trenches or during frosty weather, and a defective joint must be cut out, for it cannot be caulked up as with the lead joint in iron pipes.

Iron drains have fewer joints. They can be laid in any weather and are easily made watertight. They do not require a continuous bed of concrete, but should nevertheless be well supported behind each hub. The support should be formed about 12 inches long of fresh concrete packed carefully under the pipe and up the sides after the alignment has been adjusted and checked.

It is good practice to retain the testing water in the drain during the filling in of the ground so that any leak which may develop will be at once noticed and remedied, thus saving expense in uncovering the drain later.

Buy Bonds to Beat the Boche.

England Plans for Demobilization

THAT England is not unmindful of the approaching time of demobilization of her immense armies, is evidenced by the following article, reprinted from the London Times:

While this is highly important so far as it goes the British Government has a Department concerned with the still more important and difficult task of absorbing these men into the professional and industrial life of the state. Similarly in Canada the Department of Soldiers' Civil Re-establishment is at present engaged in an analysis of the industrial capacities and intentions of the members of the Expeditionary Forces, in order that measures may be taken to prepare the country's industrial organism to take up the discharged men at living wages.

A scheme for the demobilization of the army after the declaration of peace has been prepared by the War Office in conjunction with the Ministry of Labor. It has been rehearsed by small bodies of troops, and closely watched by many competent military observers for flaws of detail.

One of these rehearsals or experimental dispersals took place at a camp not very far from London, and occupied twenty-four hours. In that time a number of men went through the process of being freed from the army and returned to civil life. They remained soldiers; they were but acting a part; but everything was done under the same discipline and with the same attention to particulars as would have obtained if the men had been indeed carrying the laurels and emolument of one form of service into another.

Before following them through the process of release it may be as well to describe the principles of the scheme. Above everything it recognizes that ours is a citizen army, and that citizens are men with homes. Then it is based on the assumption that men who have sacrificed so much for the sake of their country are entitled to all consideration which can be allowed them consistently with the common good. One such consideration is a holiday at the nation's expense. Fundamentally, it realizes that there would be no kindness to the individual and no advantage to the community in forgetting that the soldier has to earn his living after resting awhile from his military labors. Not military convenience but social reconstruction is the mainspring of the scheme. The Army Council and the Labor Ministry are allies. The result of their co-operation should be that every man now under arms will be able to find a job as soon as he wants one; and that the soldier-beggar, who was so familiar a figure to our forefathers in the 18th and 19th centuries, will not be an object of patronage and charity to-day. The need of labor in individual industries will serve to a large extent as a guide to the demobilizing officers in the first instance; but men who have been actually in the field for two or three years will not have to wait long for their discharge and special and early care will be taken to get employment for survivors of the old army. But demobilization plans aim at placing every man. It need hardly be pointed out how employers and others can help to this end when the great opportunity of peace arrives.

Going from principles to features, one finds that the essence of the scheme lies in dispersal by locality instead of by units. This sounds technical, but is really quite simple. It means that a draft for dispersal will not be selected from one regiment or battalion, but according to the whereabouts of the men's homes. For example: a Gordon Highlander, who was living before the war or intends to live after the war in Wiltshire, will not be sent to Scotland with a solid body of his comrades; he will be included with other Wiltshire men in a draft taken to Wiltshire for dispersal. Thus he will be saved hours, perhaps days, of travel; and the railways will be relieved from the burden of accommodating him over unnecessary journeys.

Of the men who took part in the rehearsal one-half were supposed to have just arrived from France and one-half from a collecting place in the United Kingdom. All were bound for homes in a certain specified district. If they had come from the train hungry they would have been fed, and if they had been in need of sleep would have been housed. A dispersal station will have these comforts ready, though they will not be always wanted. The men were in full equipment, and had first to rid themselves of this. Having been collected on the arrival parade ground, and having paraded in convenient order, they entered an improvised office or store, where each man received a sandbag. In this he placed his private belongings. At the same time he handed over his equipment, including his rifle and (presuming him to have come from France) his steel helmet and gas mask. If any important article were missing—say, the rifle—the man had to repair to another place to give an explanation. Here the officer in charge of the draft was called in to corroborate or comment on the man's story. A satisfactory explanation ended the matter. Otherwise the soldier was debited on his dispersal certificate with an amount corresponding to the deficiency. Cases of this kind would be relatively few. A man left the equipment shed in his uniform and carrying only his greatcoat and the sandbag containing his private belongings. The intention is that soldiers shall keep their uniforms, but shall return the greatcoats on the conclusion of their furlough. Their uniforms they may wear for twenty-eight days after dispersal, and thereafter on "special" occasions only.

The "documentation" of the man is a more complicated business, and he must pass through several offices before it is completed. Men and women clerks, however, seemed to enter very earnestly into the rehearsal, and did their work quickly and carefully. All the entries, too, were checked at a separate desk. It will be sufficient here to state the outcome for each soldier. First, he gets an out-of-work insurance policy securing him, in the event of unemployment, a weekly sum, the magnitude of which will be determined later. In return for his dispersal certificate he receives a protection certificate, which he takes away with him for four weeks' furlough. It entitles him to a sum in advance at once, the remainder of his deferred pay and whatever gratuities may be voted by the Government being payable in three equal instalments during the furlough on presentation of the certificate at a post office. A label for the return of his greatcoat at the end of twenty-eight days is also issued to him, and the papers, which include the record of his military service and a railway warrant for his journey, are put into an envelope, on which is plainly marked the number of his railway group. By means of that number he finds those of his comrades who are "going the same way home"; they are warned of the time of the train's departure, and finally taken to the station and seen off. The man is at last demobilized.

The documents have been simplified as far as can be. Much study has been devoted to reducing them to a minimum. Even so, the number of them will be in the aggregate enormous. It is estimated that demobilization will take forty-five million forms. A system of codes will enable the War Office to keep in touch with progress, and to tell by rapid reference how many men in any category or group have been discharged in a particular area. The number of dispersal centres which the scheme proposes to establish is eighteen. Should men pour in too quickly the number of dispersal units at a centre would be increased. As many as three might be attached to one centre. But here it becomes necessary to warn the ingenious arithmetician against attempting to calculate the time complete demobilization would occupy.

Building Permit Records

ACTIVITY in the building trades, as indicated by the value of building permits issued in 35 cities showed a decline in September as compared with the previous month, the total value of building permits falling from $5,018,092 in August, to $2,690,821 in September, a decrease of $2,327,271, or 46.3 per cent. All the provinces except New Brunswick show decreases as compared with the previous month. As compared with the corresponding month of 1917 there was a decrease of 5.76 per cent., the value for September, 1917, being $2.855,123. In this comparison Nova Scotia and British Columbia showed increases and all the other provinces showed decreases.

Of the larger cities, Montreal-Maisonneuve, Winnipeg and Vancouver showed decreases as compared with the preceding month, while at Toronto there was a slight increase over the preceding month. Montreal-Maisonneuve, Toronto, Winnipeg and Vancouver showed increases as compared with September, 1917. Of the smaller centres Halifax showed a noteworthy gain over September, 1917, but a decrease as compared with August, 1918.

City	September 1918	September 1917	September, 1918, compared with September, 1917 Increase (*) Decrease (†)	
			Amount	Per Cent.
Nova Scotia	**$376,185**	**$189,943**	***$186,242**	*** 98.05**
Halifax	315,080	91,600	* 223,480	*243.97
Sydney	61,105	98,343	† 37,238	† 37.86
New Brunswick	**25,825**	**33,600**	**† 12,775**	**† 33.10**
Moncton	25,825	8,400	* 17,425	*208.44
St. John	......	30,200	† 30,200	†100.
Quebec	**329,527**	**425,029**	**† 95,502**	**† 22.47**
Montreal-Maisonneuve	280,325	277,458	* 5,867	* 2.14
Quebec	9,972	84,616	† 74,644	† 88.21
Sherbrooke	8,000	8,900	† 900	† 10.11
Three Rivers	14,860	21,005	† 6,145	† 29.25
Westmount	16,370	36,050	† 19,680	† 54.59
Ontario	**1,410,504**	**1,715,836**	**† 305,332**	**† 17.79**
Brantford	29,695	5,785	* 23,910	*413.31
Fort William	19,475	10,500	* 8,975	* 85.05
Guelph	6,891	9,010	† 2,119	† 23.52
Hamilton	75,000	665,140	† 590,140	† 88.72
Kingston	20,579	13,936	* 6,643	* 47.67
Kitchener	8,060	7,900	* 160	* 2.03
London	66,020	59,395	* 6,625	* 11.15
Ottawa	117,360	97,050	* 20,310	* 21.37
Peterborough	3,475	980	* 2,495	*253.56
Port Arthur	23,860	18,128	* 5,732	* 31.62
Stratford	8,177	37,993	† 29,816	† 78.48
St. Catharines	14,416	49,653	† 35,237	† 70.95
St. Thomas	9,425	22,285	† 12,860	† 57.71
Toronto	978,111	650,271	* 327,840	* 50.42
Windsor	29,950	67,810	† 37,860	† 55.82
Manitoba	**147,100**	**148,660**	**† 1,560**	**† 1.05**
Brandon	2,250	53,860	† 51,610	† 95.82
Winnipeg	144,850	94,800	* 50,050	* 52.79
Saskatchewan	**80,215**	**137,865**	**† 57,650**	**† 41.82**
Moose Jaw	17,075	10,850	* 6,225	* 57.37
Regina	20,600	22,700	† 2,100	† 9.25
Saskatoon	42,540	104,315	† 61,775	† 59.22
Alberta	**82,690**	**145,700**	**† 63,010**	**† 43.25**
Calgary	65,000	108,200	† 43,200	† 40.00
Edmonton	17,690	37,500	† 19,810	† 52.83
British Columbia	**238,775**	**53,490**	*** 185,285**	***346.41**
New Westminster	7,900	2,000	* 5,900	* 74.79
Vancouver	205,850	36,990	* 168,860	*451.60
Victoria	25,025	14,500	* 10,525	* 72.58
Total—35 cities	**$2,690,821**	**$2,855,123**	**†$164,302**	**† 5.76**

Fire Prevention Day, Oct. 9, 1918?

"IN this supreme hour," states an announcement in a recent issue of Conservation, "Canada is heedlessly burning $30,000,000 a year. . . . This fact should be brought home to every individual on Fire Prevention Day, Oct. 9, 1918. In Ontario, a Proclamation has been issued by the Lieutenant-Governor calling for the public observance of this day." The announcement proceeds to point out that in many of the larger cities and towns throughout the other provinces, "steps will be taken by the local authorities to clean up and remove the numerous hazards which occasion fire," and the pulpit, the platform and the press are urged "to play their part in this campaign."

The success which attended the institution of this "fire prevention day" and the impression made upon the public mind as to the necessity of eliminating our stupendous fire waste, was quite in proportion to the aggressiveness of the Ontario Government's campaign and the extent and striking character of their propaganda. Doubtless our readers will now be glad to know that such a day was set apart for this purpose. Some, indeed, may enquire why we did not advise them of it earlier, but as we ourselves were not "in the know," until we saw the announcement in the October issue of "Conservation," which is just to hand at the time of writing, we can only excuse ourselves on the ground that our intuition was not keen enough to anticipate the wishes of the governmental authorities in regard to the matter.

In all seriousness, however, it seems that the government has let slip a splendid opportunity for bringing home to the people of the Province the seriousness of the situation with regard to our fire losses and the urgent necessity for individual caution and effort to prevent the chance of conflagrations. We believe there is not a newspaper, journal or magazine of any kind in the country that would not most willingly have co-operated in a widespread publicity campaign, and undoubtedly the results would have been beneficial, as it seems as if the public are beginning to realize, in some measure, what our fire waste means, and what is now needed is some definite action to drive the thought home.

The idea of a Fire Prevention Day was certainly a good one, but, as mentioned above, we knew nothing of the Ontario Government's proposal, and can't find anyone who did. Perhaps, however, the Dominion Government or the municipal authorities could take up this idea, which the provincial government so signally failed to take advantage of, and exploit it to the benefit of the country at large and to their own credit.

Mainly Constructional

East and West—From Coast to Coast

Tenders were received by the city council of Moose Jaw, Sask., up till October 26, for the construction of a pipe line from Snowdy Springs to increase the city's water supply.

Good progress is being made on the new line from Moffats, N.B., to Glencoe, to connect with the I.C.R. Work was commenced about five weeks ago.

The War Trade Board has passed an order widening the control of the government over steel consumption. The order prohibits the use of structural steel, sheet shapes, plates, bars, etc., the value of which exceeds $2,000, without a license from the board.

The concrete ship "Faith" has arrived safely at a port in the Gulf of Mexico, after making a voyage from California to Chile, carrying 2,000,000 ft. of lumber. On the return trip she took a load of 4,000 tons of nitrate. It is said the vessel has stood the sea-going test without damage.

The C. N. R. tunnel through Mount Royal, Montreal, and the Lagauchetiere street station, were officially opened on Oct. 21, when the first through train left at 8.15 a.m. for Ottawa and Toronto. General Passenger Agent R. L. Fairbairn and other leading officials, with a number of prominent citizens, made the inaugural trip.

The construction work on the addition to the McAvity machine shop, on Marsh Rd., St. John, N.B., has recently been completed and machinery is now being installed. The company has also commenced the erection of a new foundry building on the southern end of their property, near Westmorland Road, some weeks ago.

Hon. G. Grierson, minister of public works for Manitoba, recently made a tour of inspection of roads in the western part of that province, accompanied by Mr. R. D. Waugh, who is awarding a shield to the municipality which has done the best work on its roads. The trip involved about 300 miles and included roads in the municipalities of Wallace, Sifton, Daly, Miniota, Birtle, Archie and Ellice.

The corner stone of a new office building for the Steel Co. of Canada, in Hamilton, Ont., was recently laid by Mr. C. S. Wilcox, chairman of the board of directors. The biuliding will be 47 x 77 ft., three storeys and basement high, with floors of concrete construction. The walls will be faced with tapestry brick from the first floor up, stone being used for the basement walls. Bernard H. Prack, architect and engineer, of Toronto, Hamilton and Pittsburgh, designed, and is constructing the building.

The first battery of the 60 new coke ovens of the Dominion Steel Corporation at Sydney, N.S., has just been placed in operation, and the second will be ready by the end of the year. When in full operation the output of these ovens will exceed 1,300 tons. The work on the big blast furnace, which has been reconstructed and enlarged, has just recently been completed, the capacity being increased to 400 to 500 tons per day. Satisfactory progress is being made on the corporation's new plate mill, and it is expected to be ready about this time next year, according to schedule.

The St. John Dry Dock & Shipbuilding Co., who have taken over the Norton-Griffiths contract, are now getting their big undertaking in connection with the dry dock construction and harbor improvement well under way. The contract, which involves an expenditure of several millions of dollars, includes the construction of a dry dock 1,150 ft. long and 125 ft. wide, with a depth of water on the sill of 40 ft. at high tide; the dredging of a basin to 32 ft., and the extension of the breakwater to 7,070 ft. Engineer Dufresne is the engineer in charge of the work. The Bedford Construction Co., of Halifax, have entered into a sub-contract for excavation work. The material excavated will be used in the extension of the breakwater.

The Woodstock-to-Ingersoll road, which has had the reputation of being one of the worst roads in western Ontario, is to be repaired. The municipalities of Woodstock and Ingersoll, and the county of Oxford have come to an agreement regarding the sharing of the cost of this work.

Discussion and agitation as to the route of the proposed Ontario provincial highway still continues. Representatives of more than fifty municipalities from St. Thomas to the border cities, who recently met at Ridgetown, passed the following resolution: "That the Government of Ontario be requested to designate and locate the proposed Provincial highway through the counties of Elgin, Kent and Essex, from the city of St. Thomas, through Fingal, Shedden and other towns and villages in the west riding of Elgin, through Highgate, Ridgetown, Blenheim, Charing Cross, to Tilbury, and from there through or near the centre of the county of Essex."

The public utility companies of Montreal were seriously affected by the influenza epidemic. The Montreal Tramways had a very large number of men off duty, about 20 per cent., and Col. Hutcheson, the general manager, was away for several days. The Bell Telephone issued a special appeal to subscribers to use the telephone only when absolutely necessary in view of the depletion of the staff. The Shawinigan Water & Power and allied companies at Shawinigan Falls were badly hit by the epidemic, and an appeal was made to the military authorities in Montreal for doctors and nurses. The Shawinigan company's hospital was full, and the technical and Catholic schools were converted into emergency hospitals. Many of the men are engaged on war work.

Personals

Mr. J. J. Carment has been appointed city manager of Kamloops, B.C.

Mr. R. F. Randolph, general superintendent of the Dominion Iron and Steel plant, Sydney, N.S., has resigned, and has been succeeded by Mr. H. E. Rice, who has hitherto held the position of assistant general superintendent. Mr. Rice joined the forces of the company in 1903, and has filled various positions in connection with the operating side of the mills.

Obituary

Mr. W. L. Foster, whose name has been well known to construction men as the Canadian agent for the Carbic Light, is reported in a recent casualty list as killed in action. The late Mr. Foster, who was born in England, came to Canada about eight years ago, when his firm first opened business in this country.

Hugh Leonard Phillips, B. Sc., died at his home in Cornwall on October 13th, of Spanish influenza. He was 28 years of age, graduated from Queen's University in 1912, and has since been connected with various engineering schemes in Eastern Ontario. At the time of his death the late Mr. Phillips was assistant to J. G. Cameron, County Engineer.

Mr. A. Bromley Smith, A.M.E.I.C., died on Oct. 20 in the Royal Victoria Hospital, Montreal. Mr. Smith was a civil engineer in the chief engineer's department of the C.P.R., in whose service he had been for 13 years, except for a short period spent in Cobalt. He was 38 years old, and came to Canada from London, England. His death was due to pneumonia.

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Contractors' Opportunity to Produce More

CANADIAN contracting builders and engineers and men of that stamp who cannot go to the front; men who in the busy building days before the war, used to engage themselves "getting things done"—expeditiously and according to contract—have an immense opportunity for a war-time service here in Canada right now. The Allies call for increased acreage. Labor for the farms is scarce. The old way of farming by one-horse or one-team—or even two teams—is inadequate to the times and the occasion. The situation calls for tractors and contractors. All over Canada there is idle land to break. All over Canada there are farmers with fields to plow. The opportunity for the man of executive ability, the man who can "get things done" in a big way, expeditiously is right here. Let him set himself to increasing the acreage for 1919.

The field is unlimited—a million, two million, three million, five million additional acres more. Canada has the idle land. She wants the man who can get things done to step forward. The idea is put forth by the Canada Food Board that contractors take the management of tractors provided by little syndicates of patriotic business men in every centre, and plow 1,000 acres or more on the contract system, just as they might contract to rush through miles of prairie railroad, or hundreds of thousands of yards of rock cutting on the North Shore. Twenty men chipping in $250 or $500 each could capitalize these ventures. Details would soon be worked out if the right men would get together. It's being done in Montreal. Another beginning is being made at Chatham, Ontario. The opportunity exists throughout Canada, particularly in the prairie provinces, where railway building, once so active, is now at pause, and where so many acres of wheat land are waiting the plough. Professional contractors may well think it over, and then get a few fellows of the right sort together to go ahead. The country needs action by business men.

Blinded Soldiers Run Private 'Phone Exchanges

THE opportunity for blinded soldiers as telephone operators, is revealed in a current issue of St. Dunstan's Review, a monthly journal devoted to the interests of St. Dunstan's Hostel for blinded soldiers and sailors in London, England, where the Canadian government is also placing its men for training.

An important article on the "St. Dunstanner as a Telegraph Operator," outlines the possiblities afforded in this particular phase of endeavor. The outstanding qualification for this work is self-reliance, as the operator in a private branch exchange generally works alone in a small sound proof room, and must do everything for himself. A full description of the necessary operations involved is given, from which it is easily seen that the brain, ear and hand of the operator must work in perfect accord, and that is possible for the blind man. Experience has shown that the blind soldier can grasp and overcome these difficulties with remarkable speed, taking only from two to three months to do so. An instance of this is cited under the heading, "News of St. Dunstan's men from all parts of the world."

P. Alvey, a telephone operator who has been working with Messrs. Debenham and Freebody, London, for the past six months, wrote recently:—

". . . I am quite used to my part of the switchboard, but after the training we get at St. Dunstan's we cannot fail to be successful. At times I cannot realize that so much could have been accomplished in so short a period. . . . I hope to get a holiday in July and will try to see two of the old boys—Harding at Cirencester, and Bundy at Gloucester. As we were all the best of friends, it will be a very happy meeting."

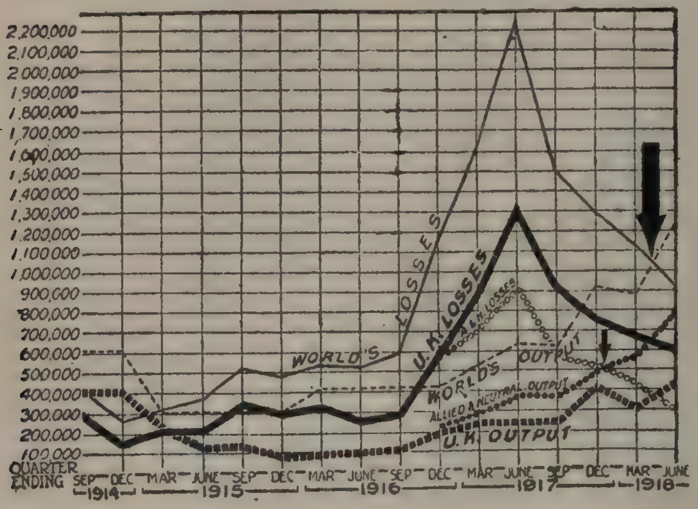
The blind person cannot, of course, work in a public exchange where the flashlight system is in vogue, but he is able to use the drop shutter switchboards, which are to be found in practically all large buildings, offices and business houses.

The training given at St. Dunstan's is of a practical nature, on apparatus similar to that in use in a private exchange. An elaborate installation has been fitted up in one of the classrooms and when a certain proficiency is attained the novice is given the apportunity of working the main switchboard of the institution. The practice on a real live switchboard completes the training.

"An unruffled temperament, a courteous and cheerful disposition and a quickly working brain are the qualifications necessary for success in this work."

The World's Shipping Losses and Output

THE diagram herewith, which is taken from the Daily Mail, of London, England, illustrates very clearly the trend of the world's shipping output, and the losses due to enemy submarines, from September, 1914, to June, 1918. It will be observed that at the point of time marked by the arrow, about May 1 last, following a comparatively sudden decrease in losses, the output rose above the sinkings. In allied and neutral shipping, the output began to overbalance the losses at the earlier date marked by a smaller arrow. Now that we have the confidence of a satisfactory conclusion of the war, we can look back and consider the seriousness of the situation which confronted us when the Hun's piracy had reached its peak, in June, 1917. At that date the sinkings of shipping belonging to the United Kingdom alone were more than double the world's total output and about five times the British output, while the world's production was considerably less than one-third of its losses. The British position, even as late as last June, does not appear very satisfactory, as the output scarcely exceeded that of December, 1914, and was still exceeded by the losses.



Wage Extortion

THE excessively high cost of living is due chiefly to the dangerous and unreasonable high wages demanded and paid for unskilled labor in Canada to-day. It is out of all reason to attempt to argue that any job requiring nothing more than manual labor makes legitimate a daily wage of from $8 to $15 a day and, in certain cases, more. Any man who refuses to do his best while employed on essential or emergency work when a counry is at war is, plainly enough, a traitor. Yet to secure the required output, manufacturers must pay a rate that makes such a wage possible. Surely it is time the government intervened in such a way as to make this most pernicious profiteering on the part of labor impossible. It was easy enough to secure men to make good our losses in France and Flanders and at a rate of pay that attaches no such stigma as profiteer. Yet labor at home becomes ever more unreasonable and domineering.

The New York Tribune states that a riveting crew in an American shipyard drove 1,300 rivets in one 7½ hour shift, for which they were paid $156, the leader's share amounting to $69.33. This is not the record for riveting either; it is far below the maximum, yet the average number of rivets driven in the various shipyards is about one-tenth of this figure. Where a man is after a record, it is possible for him to drive a sufficient number of rivets in 7½ hours, at the rate at present paid, to secure for himself a wage of $69.33 per day. When he is not out for a record he works just one-tenth as hard, realizing that the piece work rate would be reduced should he make anything like $69.33 every working day.

A glance over our casualty list in the daily papers brings home to us very forcibly the sacrifices being made and the hardships being endured by our men on active service, yet any attempt to secure extra effort at a fair wage from some of our industrial labor is met with the threat of a strike. If these conditions are permited to continue they will prove destructive to all legitimate enterprises and drastic action, to prevent peril to all classes of citizens, must be taken.

The wage must conform to the cost of living and should be rated according to the efficiency of the individual. The condition existing to-day is that the cost of living is conforming to the extortionate wage.

Architecture in Bridges

ELSEWHERE in this issue, there appears an article by Mr. F. G. Engholm on the architectural treatment of reinforced concrete bridges. Mr. Engholm deals, for the most part, with the broad principles of this question, rather than its practical details, but his remarks strike deep and are, we believe, very timely.

The article makes reference to the general trend of architectural practice, and points out the glaring lack of originality and even of good taste displayed in most of our work. It is strange indeed that we of the Twentieth Century, who have progressed by leaps and bounds in science, industry and agriculture, should show such a retrograde tendency in the arts—and particularly in the architectural art, upon which the happiness and welfare of the human race to so great an extent depend. Even our best efforts are, in general, but mimicries of the creations of other ages. We have neither the patience and the painstaking craft to make a really good imitation nor the genius to produce an original work expressive of our own age.

Some will say that the rush of modern life presents insuperable obstacles to development in the arts—that modern methods do not lend themselves to the production of artistic creations. Undoubtedly our poverty of artistic genius may be attributed to our way of living, but in the architectural field at least, we can offer no excuse on the grounds of facilities or methods, for these are quite as adaptable to the production of beautiful structures as to the monstrosities and cheap imitations with which our cities are crowded. Indeed with our increased engineering and construction equipment and our large scale operations, we have all the greater opportunity for bringing about harmonious development and at the same time introducing that variety which is the first essential of a beautiful town or city.

The fault lies entirely in our viewpoint. As a race, we have lost our love of the beautiful. Of course, we still admire beauty when we see it, but it has been entirely forgotten when opportunities for "economy" have been presented. Thus, in our efforts to save dollars and cents we have built ugly structures, and by living amongst ugly structures we are stifling the genius to produce, and the ability to appreciate, true architecture. Of course, as Ruskin has put it, the first virtue of architecture is "to act as it is intended to act, and do it in the best way." But our viewpoint has been lamentably narrow. A factory has been considered only as a building to house an industry, not as an institution in which human beings spend the greatest part of their waking hours, and which should preserve their mental and bodily condition. A bridge, in our estimation, is but a structure to carry traffic over a stream or a ravine, not something which should harmonize with Nature's creations and form part of a landscape. Art, real art, has been considered as lying entirely ouside the industrial field, not as a means to relieve its drabness, put a soul in it, and permeate it with a saving and humanizing element. What we have been pleased to call utilitarianism and economy is nothing more nor less than penuriousness. We have grasped at the few odd cents and have lost the larger and lasting benefit.

This Victory Bond issue is probably the best investment you will ever have a chance to make. It will pay you to buy more yet.

Extension of Laurentian Sanitorium

PLANS have been drawn up by the Public Works Department for the extension of the Laurentian Sanitorium, St. Agathe, P.Q., in connection with the Laurentian Society for the Treatment and Control of Tuberculosis. The extensions are for the accommodation of invalided soldiers, and form part of the work of the Department of Soldiers Civil Re-establishment. The new buildings consist of five pavilions, a service building, power house and two tunnels, all the structures being separate.

The pavilions are all of the same character, both as to accommodation and construction. The exteriors are of stone, lathed with Bishopric lathboard applied to one-inch furring strips, Bishopric board also being used in the interior. All the walls, ceilings and work furred off is to be plastered with Paristone hard wall plaster, an exception being made in the case of the wards. The floors are supported by concrete piers, 12 x 12 ft. centre to centre. The buildings have asbestos shingle roofs, while the interior staircases are of birch and fir. The pavilions consist of two storeys each, the latter being laid out on the same plan. Entrance is obtained by outside two-way staircase, in the centre of the exterior. The first floor contains living rooms, cure verandahs (screened), with inside wards divided from the verandahs by screens; dressing rooms, with a central hall, nurses' room, emergency ward, toilets, etc. A central inside stairway leads to the upper portions of the building.

The service building, with much the same constructional features, contains, on the basement floor, a butchers' shop, dairy, meat and fruit refrigeration rooms, general stores, ice-making plant, quarter-master's stores, coat-room, and bedrooms. The entrance is from the rear. The first floor has accommodation for the help, dining rooms, bakery, dining hall, cafeteria, kitchen, stores, vegetable room and toilet. The second floor contains living and bedrooms.

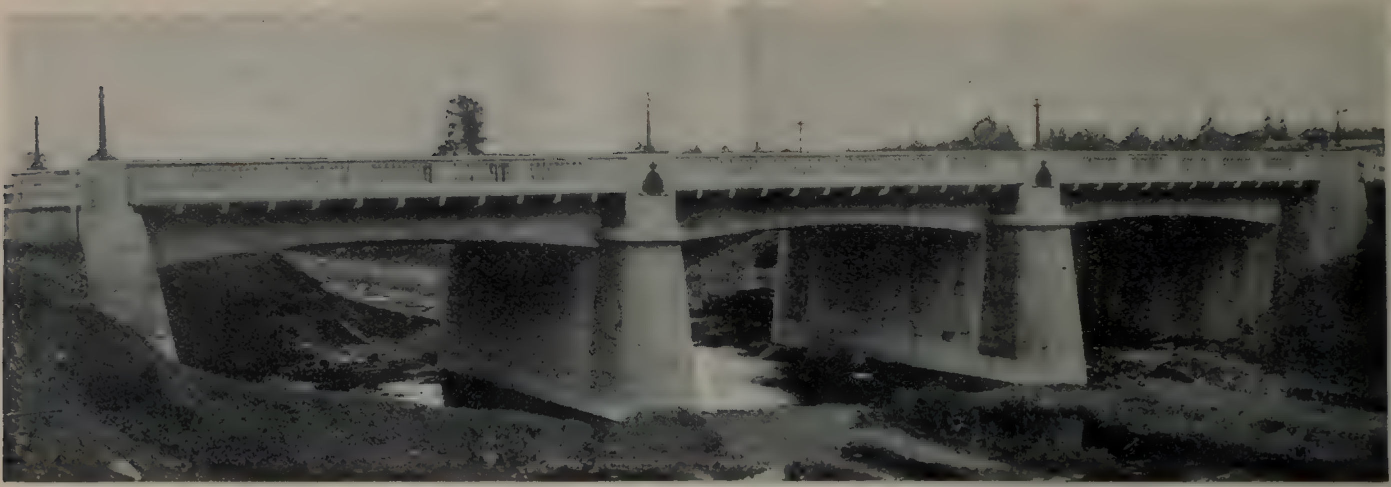
The power house will be built of stucco on concrete blocks, with concrete floors. The coal bunkers occupy nearly the entire front and divided from them by concrete walls, is the boiler room. At the side is the engine room, containing several electric motors and the pumps; there is also a workshop and an office. It is proposed to remove the equipment from the present power house, and to instal additional boilers, generating sets, and pumps. The roof will be of felt and gravel, supported by trusses. A Kellog radial chimney of perforated bricks will be constructed. The mains for heating, steam, etc., are to be run in a tunnel, of reinforced concrete, 230 ft. long, from the power house to the infirmary, and in a similar tunnel, 120 ft. long, from the infirmary to the service building.

Canadian Builders' Congress in Ottawa

A PRELIMINARY notice and programme of the conference of Canadian Building Industries, which, as announced in a previous issue, it has now been decided to hold on November 26, 27, 28, in Ottawa, is being distributed. The items of business to come before the conference are enumerated as follows:

1. Registration and Sectional Roll Call.
2. Appointment of Temporary Officers—Chairman, Secretary and Treasurer.
3. Appointment of Committee on Points of Order—Three Members.
4. Resolution on Organization of Convention and Finance.
5. Election of Convention Officers.
6. Appointment of Publicity Committee—Four Members. Daily Reports; Trade Papers; Building Statistics.
7. Resolution re Canadian Association of Building Industries.
8. Appointment of Committee on permanent Organizations. Ten Members. Future of Builders' Exchanges. Our Relations to Board of Trade and Manufacturers' Associations, etc.
9. Appointment of Committee on Resolutions and Order of Business—Six Members.
10. Appointment of Committee on Attendance or Membership—Five Members.
11. Appointment of Arrangements Committee—Five Members.
12. Appointment of Building Situation Committee—Twenty Members plus:
    (a) Public Works; Good Roads; Railroad and Corporation Work.
    (b) Industrial Housing.
    (c) Agricultural Development.
    (d) Building Materials; resources, economy, adjustment, standardization; Builders' plants, yards, etc.
13. Appointment of Business Relations Committee—Twenty Members plus:
    (a) Percentage: Cost plus fixed sum:—Owners.
    (b) Method of calling and opening tenders: Engineers; Architects; Sub-Contractors; Powers of Inspector or Superintendent; Arbitration.
    (c) Foreign Competition and Designing.
14. Appointment of Committee on Labor Conditions (present and future)—Ten Members plus:
    (a) Labor and Trade Parliaments.
    (b) Employers and Apprenticeship—Technical and Vocational Training.
15. Appointment of Legal Affairs Committee—Ten Members plus:
    (a) Building By-Laws, Lien Laws and Privileges.
    (b) Guarantees: Bid bonds versus bid cheques; contract bonds; standard agreements; unit prices.
16. Appointment of Code of Ethics Committee—Ten Members plus:—Receiving bids; awarding sub-contract work; Supply Houses; Payments; Bonds; Bonds and Penalties; Zones of Operation.

The big financial concerns are buying as heavily as possible. That should satisfy you as to the value of Victory Bonds as an investment—Buy some more.



Church Street Bridge.—This is a reinforced concrete bridge, designed by the author for the City of Montreal. This bridge is a similar structure to LaSalle Bridge, shown on the following page. The illustration shows the work nearly completed.

Reinforced Concrete Bridges and Their Architectural Treatment

By Mr F. G. Engholm*

THE influence of engineering structures upon the community life of people is of great national importance. The standards of beauty are enlarged with the growth of knowledge.

The creation of beautiful structures can only be attained by a full and true knowledge of the kind of materials used and by certain subtle distinctions born of integrity of purpose and refinement in handling them.

The use of masonry for bridges must now be regarded as a thing of the past, chiefly on account of the prohibitive cost. The longest single span in masonry in existence is 295 feet. The rise and dimensions of a masonry arch are necessarily large and are especially noticeable in spans of any appreciable magnitude. And further, the restrictions of site such as clearance and depth of construction, often limit and affect the general design, economy, etc., of the structure so as to render the use of masonry prohibitive in face of modern developments.

The graceful lines of a reinforced concrete arch bridge with a shallow rise and comparatively small dimensions of the various members, give a touch of refinement which cannot be approached in any other material.

In steel structures the aesthetic treatment assumes a different character. To attempt to ornament any steel structures of large span would be entirely false, and foreign to the fundamental principle of their design. Its application, if done at all, could only be carried out consistently by a great increase in weight and sacrifice in economy. In the case of the Forth and the Quebec bridges, for instance, no pretence is made to decorate these structures. They are too collossal in proportion, themselves, to require any such treatment. The designer of the Forth bridge stated that the design pretended nothing but to tell the truth as simply as possible and, inasmuch as it does, it is beautiful.

These massive structures are rare occurrences in the history of a country and in dealing with "everyday" structures, reinforced concrete, in its dimensions and applications, gives proportions of beauty all its own.

The steadily increasing use of reinforced concrete as a structural material in the last few years thus opens up a line of thought in its architectural treatment, worthy of the best effort of the artistic as well as the practical mind. Designers, apparently, have not yet realized the structural possibilities of reinforced concrete or else they lack that special knowledge of the material to foster its more prolific use in their works. In a few cases, however, designers, mostly of the younger and more progressive element, are investigating its possibilities.

To confine myself to bridges and their particular architectural treatment in the space of a short article, it is necessary to condense and be brief. At the outset, it is well to realize that reinforced concrete is a material that one must have a special, practical and studied knowledge of, to create development along the right lines. No amount of collaboration of architect, artist and engineer, will create a thing of beauty if one and all do not appreciate and thoroughly understand the application of this material.

I am not condemning this collaboration of architects, artists and engineers, so long as the combination working together know the material they are assembling. For instance, take the case of the Bassano dam. Here the combination was not successful. This is a magnificent piece of reinforced concrete engineering, which is surmounted with gate houses designed by the collaborating architect in a half-timber affectation which seems altogether out of keeping with the ponderous structure beneath. The very permanence of reinforced concrete demands that its accessories be permanent also.

The art of building, generally, at the present time, seems to be at a serious crisis; look where we may, nothing is seen but a hodge-podge of styles, or rather periods—oriental freaks and French wedding cakes

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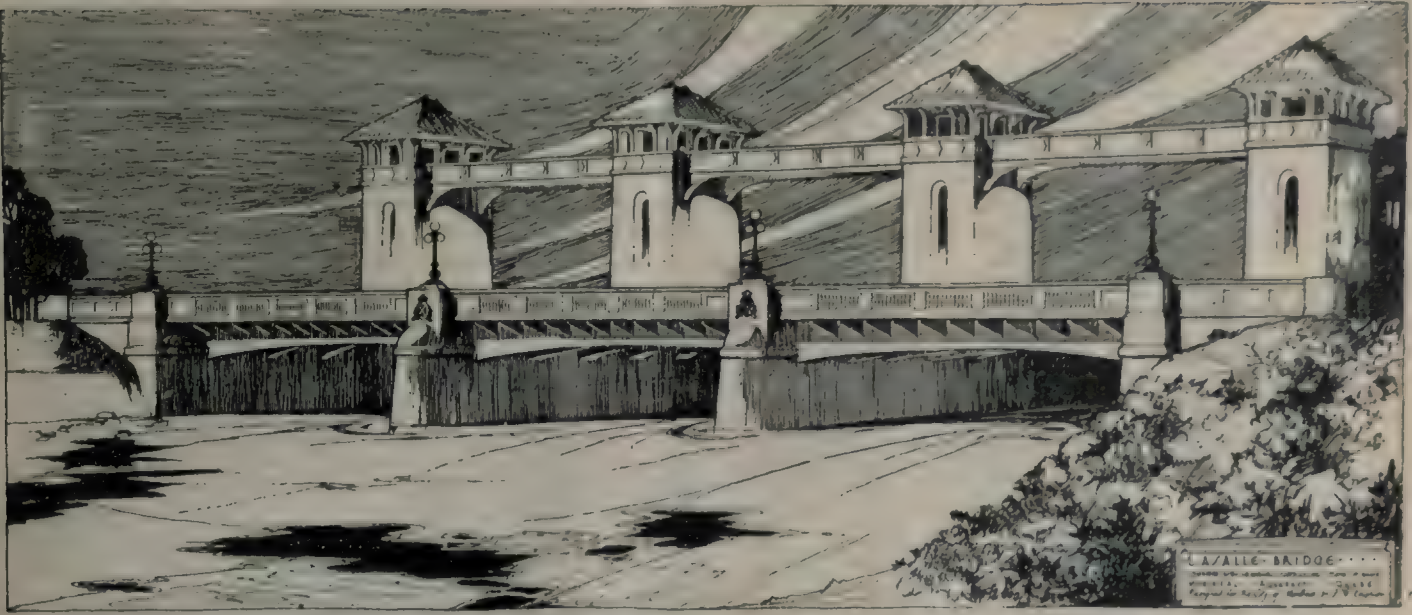
*Reinforced Concrete Engineer, Toronto, associated with Francois Hennebique, Paris, and L. G. Mouchel and Partners, London, Eng.



LaSalle Bridge.—This is a reproduction of a perspective drawing of a structure designed by the author for the city of Montreal. It is a continuous girder bridge in reinforced concrete, combined with three 65-foot Stoney head-gates controlling the flow of water in the new aqueduct, Montreal. The towers and overhead structures house the counterweights and operating machinery for the gates. The roofs of the towers are of red Spanish tile, unglazed. The parapets, etc., of the operating bridge are relieved with red tile inserts at intervals as shown. The center piers are decorated with City of Montreal coats-of-arms in cast metal, finished verd antique.

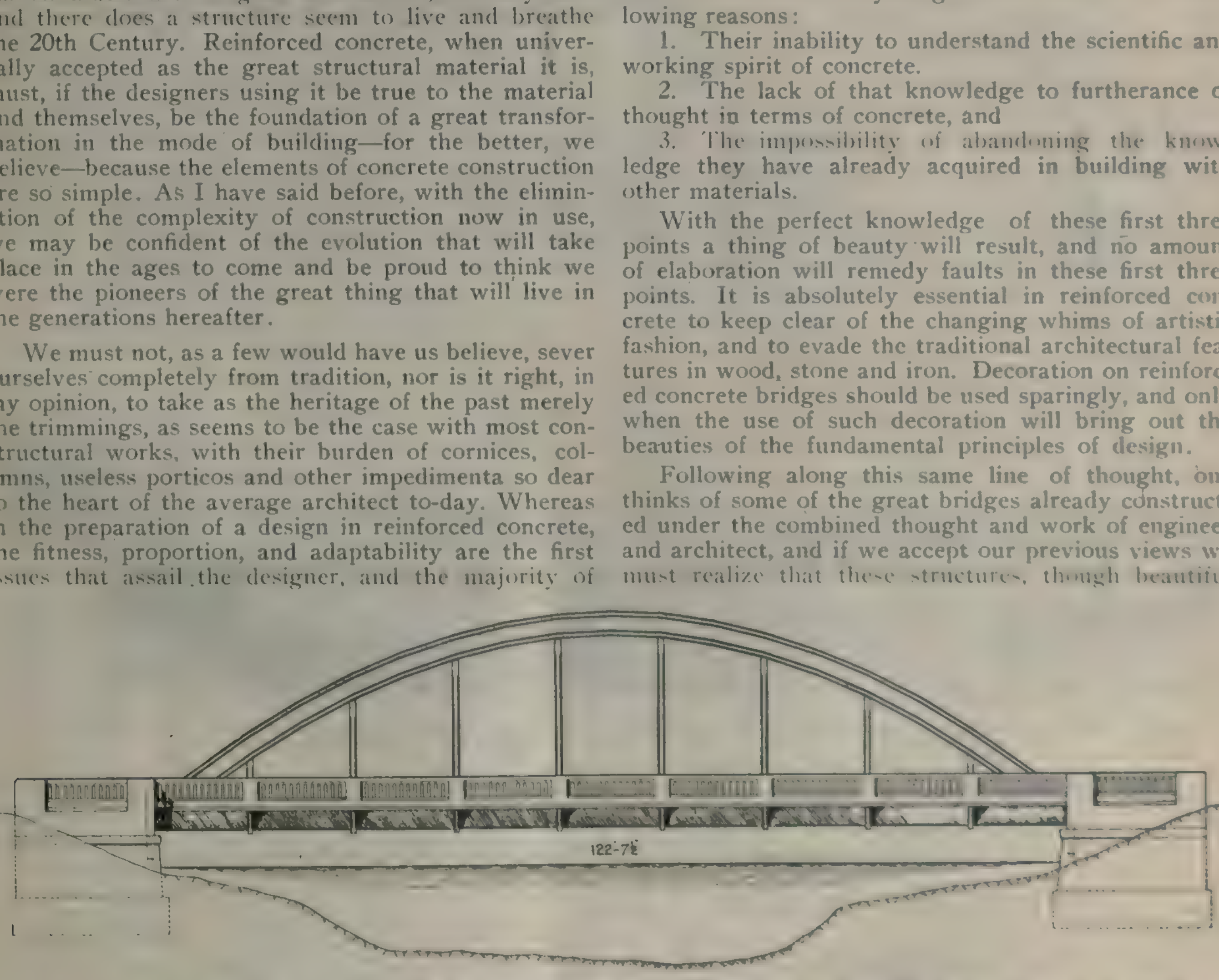
rub shoulders with English affectations, and only here and there does a structure seem to live and breathe the 20th Century. Reinforced concrete, when universally accepted as the great structural material it is, must, if the designers using it be true to the material and themselves, be the foundation of a great transformation in the mode of building—for the better, we believe—because the elements of concrete construction are so simple. As I have said before, with the elimination of the complexity of construction now in use, we may be confident of the evolution that will take place in the ages to come and be proud to think we were the pioneers of the great thing that will live in the generations hereafter.

We must not, as a few would have us believe, sever ourselves completely from tradition, nor is it right, in my opinion, to take as the heritage of the past merely the trimmings, as seems to be the case with most constructural works, with their burden of cornices, columns, useless porticos and other impedimenta so dear to the heart of the average architect to-day. Whereas in the preparation of a design in reinforced concrete, the fitness, proportion, and adaptability are the first issues that assail the designer, and the majority of them fail to create anything worth while for the following reasons:

1. Their inability to understand the scientific and working spirit of concrete.
2. The lack of that knowledge to furtherance of thought in terms of concrete, and
3. The impossibility of abandoning the knowledge they have already acquired in building with other materials.

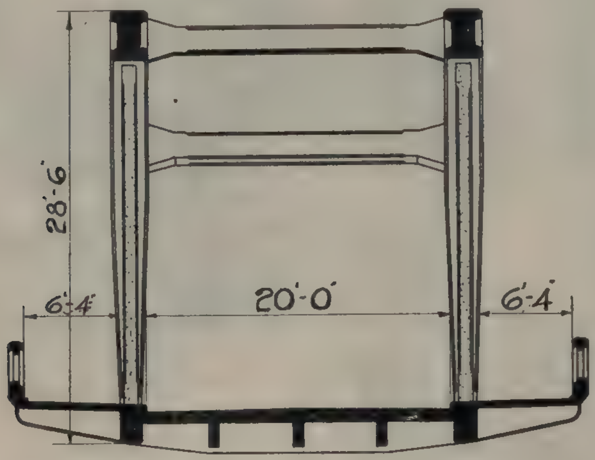
With the perfect knowledge of these first three points a thing of beauty will result, and no amount of elaboration will remedy faults in these first three points. It is absolutely essential in reinforced concrete to keep clear of the changing whims of artistic fashion, and to evade the traditional architectural features in wood, stone and iron. Decoration on reinforced concrete bridges should be used sparingly, and only when the use of such decoration will bring out the beauties of the fundamental principles of design.

Following along this same line of thought, one thinks of some of the great bridges already constructed under the combined thought and work of engineer and architect, and if we accept our previous views we must realize that these structures, though beautiful



This illustrates one of the four bridges designed by the author for the Toronto & Hamilton Highway Commission, now under construction at Mimico, Etobicoke, Port Credit and Bronte. This compares with the through girder type of bridge in steel in themselves, as specimens of studied poetry, fall short of the great idea. For the most part, they embody forms and details which we readily associate with other materials. Cannot the designer think in other terms than the five orders? To me there is only one order—**"Fitness."**

As a simile might I for a moment be excused a diversion:—Take the automobile; the first of these modern means of locomotion were naturally very similar to the carriage, and in some very early drawings, indicating the ideas prevailing at that time, one might find the two personages, coachman and footman of the old staid carriage, mounted up high, in front of the vehicle, and even in some cases, the means of steering was illustrated as a sort of rein attachment in the hands of the coachman. In comparison, look at our modern auto, the acme of engineering perfection, bearing no resemblance to any other vehicle; this upon careful analysis, is found to be purely a matter of elimination and simplification.



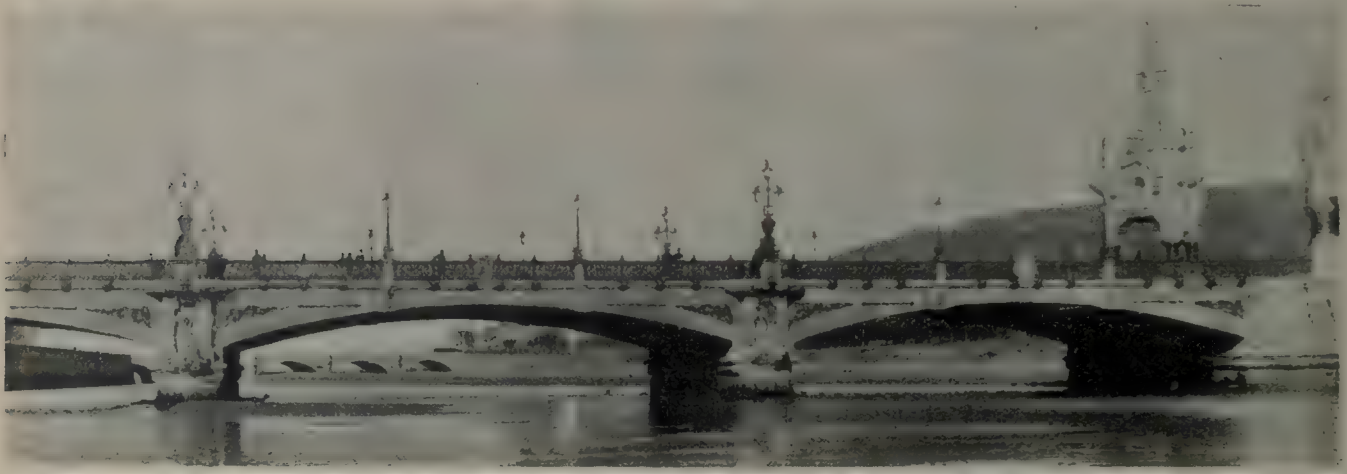
Cross sectional drawing of Toronto-Hamilton Highway Bridge

Thinking of reinforced concrete bridges in a more intimate way than we have above, several phases of character present themselves, and when we realize the distinctness of concrete from all other materials, we must appreciate the opportunity that knocks at our door for a distinct expression. Among these characteristics is the solid purity of line, the mass, the bulk, whatever one cares to apply, should undoubtedly dictate the first steps in a reinforced concrete creation; next, probably, the thought comes of the way in which this material is assembled, i.e., poured. This seems to dictate flowing lines, continuity, and elimination of all the small distractions. A structure designed to comply with these and the other three points previously raised and truthfully dictating its function cannot but lift a new standard to the world to proclaim the progression of the 20th century.

That severe critic of the Building Art, Ruskin, whether we accept all his statements or not, was right when he said "Nothing is beautiful that first is not true."

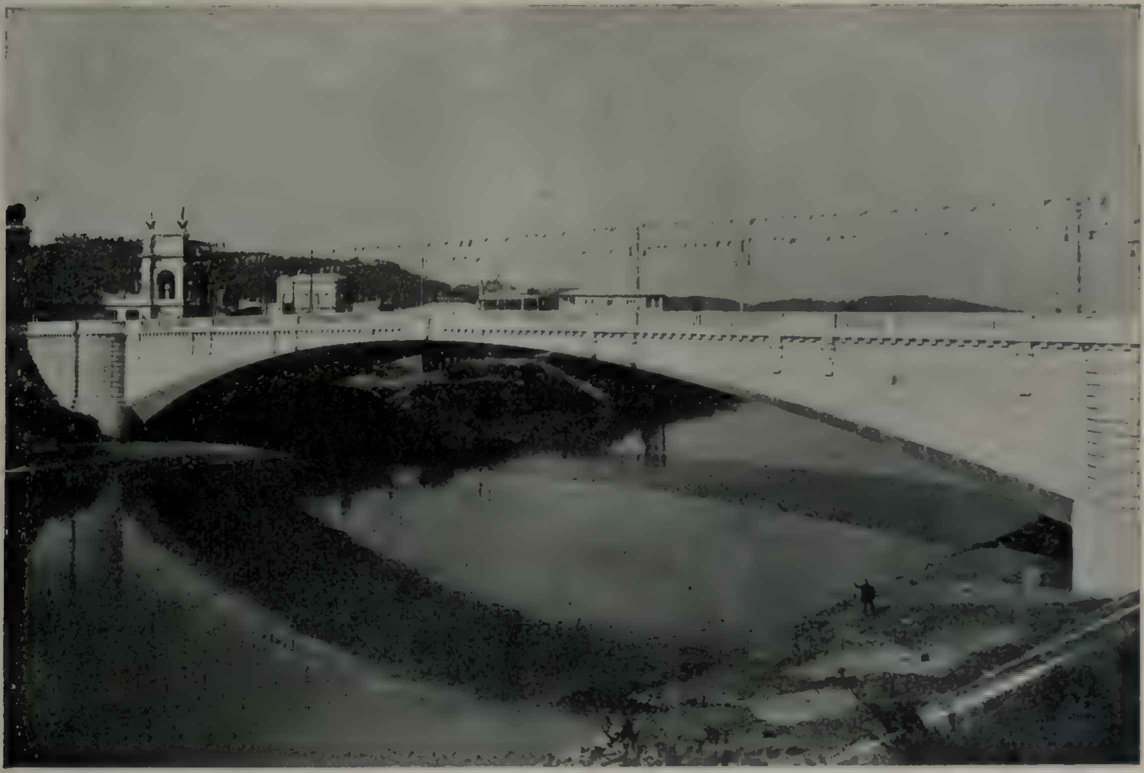
I have dwelt above on the error of trying to produce a living structure by using forms associated with other materials, and must indulge the reader's forbearance in repeating this remark, as its importance cannot be too strongly emphasized. There is still a more intimate imitation that must strenuously be avoided, and that is the actual reproduction in concrete of some other material, such as rock-faced ashlar, rusticated stonework; these and many others are a degradation to reinforced concrete and an insult to the material it imitates. To the expert designer the treatment of the finished concrete should open up many new interesting effects. Many of those already in popular use are:—the careful selection of a surface aggregate which is then either polished, producing that beautiful effect we know as terrazzo, or by sand blasting the surface marks from the interstices and leaving the aggregate free, producing an effect similar to rough cast. Then again, the aggregate may be varied by the use of either lime stone, granite or marble chips, which might all be combined or used separately at different points of the whole structure without destroying its continuity.

The one great thought that raises itself in connection with the decoration of a reinforced concrete structure is, that it must of necessity be of the structure. This is the argument of the Gothic revivalists in favor of their style, of which there is scarcely an old world example existing that is not beautiful. The idea of precasting tons of useless features heretofore associated with stone, at present expressed in so many of the concrete structures already built, is in no way significant of progression, and as soon as we forget the cornice as it is at present detailed, and the column of ancient Greeco-Roman times, and give our more strenuous attention to such means of decoration as



Bridge at San Sebastian, Spain.—This is a reinforced concrete structure, designed by Francois Hennebique, of Paris. It is finished in highly polished terrazzo, composed of black and white marble aggregate and crushed marble sand.

burnt clay, tile insertion, etc., the more readily will the ground be clear of weeds to begin ploughing through this vortex of existing affectations. At this point, I feel it would be as well to say a few words about the decorative value of iron work. Because a bridge is of reinforced concrete, it would be ridiculous to assign the material to some duty for which it was not functionally the best suited; wrought iron used carefully, and lovingly designed by an appreciative craftsman, will add greatly as an accessory to the general effect. Gates, lamps, and sometimes standards, trolley poles, coats of arms, metal weatherings, inscriptions, if properly designed, lend that touch of contrast so necessary to any work of art. Contrast and harmony are synonymous in the hands of the gifted.



Risorgimento Bridge, Rome, Italy—328 ft. span.—This reinforced concrete bridge was designed bv Francois Hennebique of Paris. It is 65 ft. 6 in. wide, carrying double electric car tracks, roadway and sidewalks. The arch has a rise of 32 ft. 10 in. and the over-all depth of construction at the crown is 2 ft. 9½ in.

Applying reinforced concrete to bridges, relieves us of one of the greatest obstacles to beautiful structures: the elimination of complexity in constructing a structure whose function is simple; the functional idea should then be the key note of all reinforced concrete bridges. The bigness and, at the same time, the smallness of the function, is such as to simply demand the elimination of trivial details, especially seeing that we cannot comprehend the beauty of a bridge except at a comparatively great distance. The human eye would fail absolutely to appreciate for instance, small heads at intervals on a string course, so it would seem as well to confine any of the smaller elaborations to the roadway itself, such as the decoration of lamp standards, seats, coats of arms, trees, shrubs, etc., etc., where the human eye can readily grasp their significance, and enjoy their beauty.

It is readily seen from the foregoing remark that to make a successful project it is not necessary to spend an enormous amount of money. In point of fact, the percentage on the cost of the whole structure can scarcely be appreciated, it is so small. The ease with which these decorations can be effected is also a consideration; the majority of them can be left out without destroying the beauty of a design, and placed at some more appropriate time. Of course, there are still those first three points which should stand, and in themselves create a beautiful bridge, with the other adornments merely as furniture to the home.

In conclusion, I want to touch briefly on the subject which is far from the least important and which as yet I have refrained from talking about until this stage. I refer to color. There seems to be in reinforced concrete a chance that we shall again take up a true heritage, handed down to posterity by the ancients, which, in the last century, has gradually dwindled and waned until our surroundings are as drab as our lives. If we study classical architecture it will be found that our ancestors were partial to building in colors. The excavation of classical buildings at Var Catena, Brioni Grande, and Barbariga, has brought to light many proofs of this. We can understand, to a certain degree, in countries with temperatures such as in England, that color is not so important, but in a continent such as ours, with its brilliant sun and more brilliant snows, color is the greatest note we can strive to incorporate, and so in our bridges and great engineering works, which in so large a number of cases, are built in such close juxtaposition to nature, do not forget that God intended color to be one of the most beautiful notes the human can strike, just as He played it in the supremest creation of all.

An excellent sandpaper block for use on curved surfaces is made by attaching a piece of heavy leather to split block. The block is first grooved and finished. The leather is then glued to the lower surfaces. The sandpaper is cut to the proper size and glued to the leather.

A Self-Contained Floating Caisson

WE are in receipt of an interesting letter from Mr. John Taylor, C. E., Hamilton, Ont., of the firm, McAllister & Taylor, general contractors, in which attention is drawn to a paper recently read by Mr. J. J. McDonald, on the Diving Bell, which is being used in the construction of the foundations of the dock walls at the new Halifax Terminals. In this paper, Mr. McDonald calls his device a Floating Caisson or Diving Bell, and claims to be the originator of this type of apparatus. However, Mr. Taylor points out in his letter that as early as August, 1913, he had invented and used in the city of Hamilon, a diving bell of the type described by Mr. McDonald, and that a description of it appeared in "Engineering News" of date April 23, 1914. Mr. Taylor adds:

"Previous to its use in Hamilton, there was no self contained floating caisson capable of being moved by air pressure and loaded with water ballast, in use anywhere on this continent, and the method adopted certainly was not used at any of the European ports, although a large deep-water diving bell for rock drilling purposes, with the air lock shaft supported in the centre of a large steel scow and held down by the weight of the scow, was used by a firm of admiralty contractors in the excavation of several million cubic yards of rock in the entrance channel of Plymouth Harbor. This particular machine was designed by Mr. Humphreys, now the Chief Engineer to the London County Council, and the writer was at one time, a member of the engineering staff of this company. This machine does not depend on water ballast to resist the upward air pressure, but would probably, for the conditions at Halifax, have provided a more reliable and safer machine for doing the work, as the stability of the Halifax machine had frequently, the writer understands, to be maintained when floating near the surface with the assistance of a derrick on an attendant scow, probably partly due to the fact that the design was not strictly correct."

In view of the interest attaching to the subject, we are giving herewith a detailed description of Mr. Taylor's diving bell, as used in Hamilton, in 1914, in the construction of a wharf for the Canadian government:

Construction of Caisson.

The working chamber is 7 x 18 ft. in plan and 7 ft. high inside. In this work the pile bents were spaced at 11-ft. centres and measured 16 ft. overall across the wall. One pile bent at a time was covered by the caisson. The maximum depth to which the water was required to be depressed in order to give clear access for placing the cross timbers and longitudinals in the dry was 3 ft. below zero level of Lake Ontario.

The framework of the chamber consisted of 4 x 6-in. beams of white pine with cross bracing and longitudinals in the ballast tanks and A-trusses on top and bottom of the tanks to stiffen the framing, all securely bolted with ⅝-in. bolts. The top and bottom end timbers were of 6 x 10-in. Douglas fir. Across the top of the air chamber, and running longitudinally a 10 x 12-in. timber of Douglas fir was placed to take the upward air pressure on the centre of the roof of the caisson. The ends of this beam were tied down through the end 6 x 10-in. timbers with 1½-in. tie-rods and an A-frame truss is placed with these rods as tension members on the ends of the air chamber.

The water-ballast tanks and air chamber were built of specially well-dried seasoned white pine. The tongued-and-grooved joints of the 2-in. planking were filled with a thick solution of asphalt which was chosen on account of its elastic properties and the whole apparatus was painted with the same material. The outside exposed ends of the air chamber were double sheeted with 2-in planking tongued-and-grooved.

The inside of the walls and roof of the working chamber were lined with heavy galvanized iron, all joints and nail heads being heavily soldered to prevent air leakage. Horizontal fenders to protect this lining were placed around the inner sides and edges of the chamber. On each of the four outside corners were placed spuds of 10 x 10-in. timber 32 ft. long. These were raised and lowered by wire cables running from a hand-operated capstan placed on the centre roof beam. These spuds, if desired, were provided as anchorages and as a protection against possible breakdown of the air supply, and were intended to be dropped immediately should this occur. They were not, however, vitally necessary to the successful operation of the apparatus as a whole.

Access was provided to the working chamber by means of an air-lock placed in the roof of the working space. The doors of the lock were of wood of heavy construction with heavy hinges and a clamping arrangement. The hinges were set so as to bring an even pressure over the whole bearing surface of the doors. The meeting surfaces were mitered and provided with rubber bearing surfaces to give an air-tight joint. This made a simple and effective airlock.

Four ½-in. air valves were provided for controling the lock, which could be operated, two from the inside of the lock, one from the working chamber and one from the outside. A steel lock of the usual type could, of course, be used.

The working platform was suspended by ½-in. dia. manila rope from sets of double and single blocks The platform frame was made the full size of the chamber and fitted with loose removable planks forming the platform. Working equipment such as clips to hoist the timbers to be framed up were suspended by ropes on blocks from eye-bolts and rods on the roof of the working chamber and suspended tool boxes were provided. All tools were secured by a light line to prevent their being accidentally dropped in the water and lost through the open bottom of the caisson.

A telephone was provided, the instrument on the inside being removable to prevent it being damaged by water when the caisson is sunk, and the cells were placed in a water-proof instrument box on the outside wall of the air lock. A separate high-pressure air connection was provided for an air wood-drill and saw inside.

A water-gauge glass, with cutoff valves which could be closed in case of glass breakage, communicated with the water outside and allows the exterior water level to be read inside, and when the reading was obtained from the dock water gage the level could be transferred very closely for setting out the construction inside the working space. A large scale low-pressure air gauge on the roof graduated to ounces, showed at a glance the air pressure in the caisson.

On the four outside faces of the caisson, gauge boards, graduated to inches, showed the level to which the lower edge of the working space was depressed below the outside water surface. To provide light, two small windows, double, of heavy wired glass, protected by gratings, were fitted in the roof in rubber seats, but on dull days ordinary lamps were used to light the working space.

At Hamilton, the depth to which the water was depressed inside the working space did not exceed 6 ft. and as 1 lb. superatmospheric pressure will depress water approximately 2 ft. the pressure under which the men worked did not exceed 3 lb. per sq. in. for 6 ft. depression.

To empty the water-ballast tanks it was only necessary to open the 6-in. diam. water valves and retain the air in the working chamber when the ballast tanks would discharge their load and the apparatus again rise in a few minutes into the position shown in Fig. 1, the valves being then closed. In order to completely expel the water from the ballast tanks, the air valves communicating with the working space admitted air to the tanks which forced the remainder of the water through the 6-in. water valves. This could be done to obtain a specially light draft, and with the tanks unloaded thus, the light draft did not exceed 1 ft. 6 in. in the machine described.

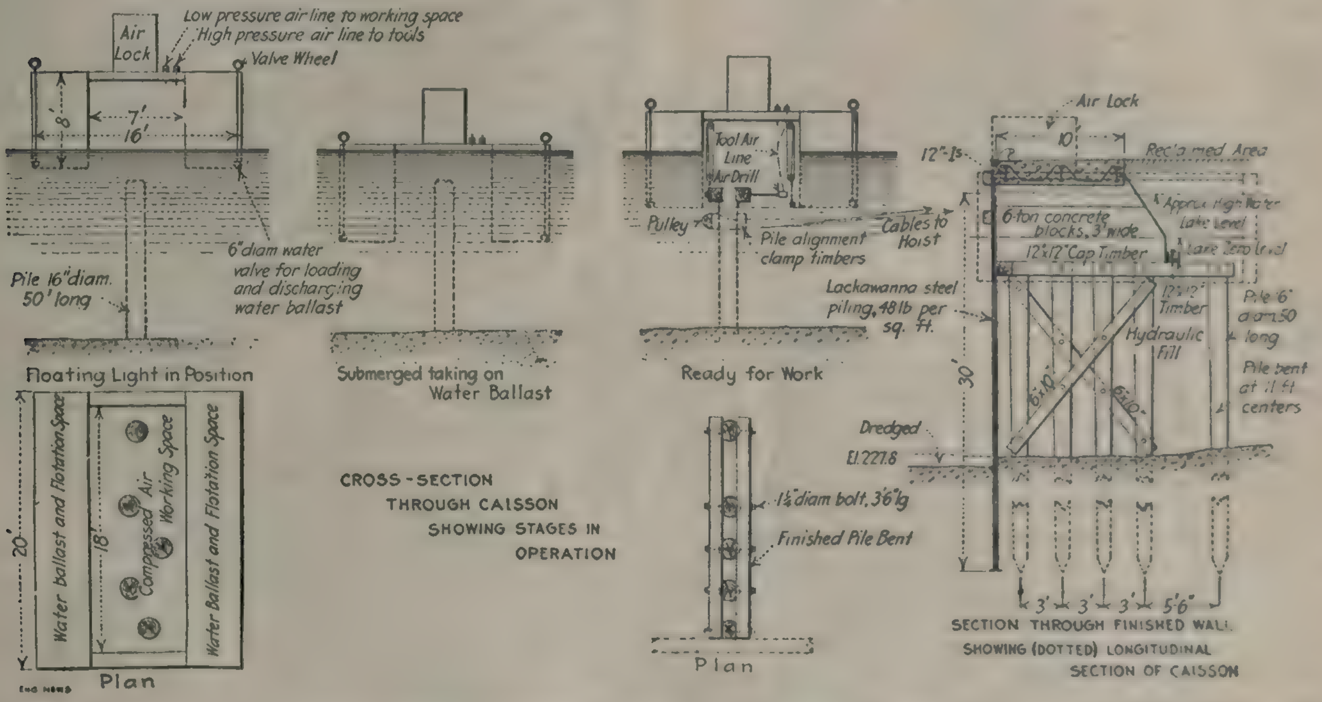

Air Lock
Low pressure air line to working space
High pressure air line to tools
Valve Wheel
8'
7'
16'
6" diam water valve for loading and discharging water ballast
Pile 16" diam. 50' long
Floating Light in Position
Submerged taking on Water Ballast
Tool Air Line
Air Drill
Pulley
Pile alignment clamp timbers
Cables to Hoist
Ready for Work
Water ballast and Flotation Space
Compressed Air Working Space
Water Ballast and Flotation Space
20'
18'
Plan
ENG NEWS
CROSS-SECTION THROUGH CAISSON SHOWING STAGES IN OPERATION
1¼" diam bolt, 3'6" lg
Finished Pile Bent
Plan
Air Lock
10'
12"-Is
Reclaimed Area
6-ton concrete blocks, 3' wide
Approx High Water Lake Level
12"x12" Cap Timber
Lake Zero Level
Lackawanna steel piling, 48 lb per sq. ft.
12"x12" Timber
Pile 6" diam 50 long
Hydraulic Fill
Pile bent at 11 ft centers
6"x10"
6"x10"
30'
Dredged
El. 227.8
3'
3'
3'
5'6"
SECTION THROUGH FINISHED WALL SHOWING (DOTTED) LONGITUDINAL SECTION OF CAISSON

Fig. 1. Progressive Details of Operation of Caisson in Capping Piles for Sea Wall

The air supply was provided by compressor capable of delivering 100 cu. ft. of free air per minute, placed on a separate scow moored alongside, steam being supplied by a 30-h.p. boiler also placed on the scow. This compressor also supplied air to the one diver necessary on the work who followed behind doing incidental work of any kind.

Air lines of ¾-in. diameter rubber hose ran from the storage tanks; one supplied low-pressure air for the working chamber and the other high-pressure air for a wood-drill which was used on all boring for bolts in the timber work. These air lines were atached to the roof of the working space.

The high-pressure line supplied air at 95 lb. per sq. in. while the low-pressure line supplied air for the working space, cut down by an air-reducing valve to a little above the actual pressure required. This surplus pressure was allowed to blow off through a safety escape valve in the roof to purify the air, and it also made good any air leakage. Of course, as soon as the air pressure rose too high, on account of the exhaust from the air tools, it blew off under the lower lip of the working chamber and thus automatically regulated the water level inside the working space.

In the event of a serious breakdown of the air compressor or piping, instructions were given to the operator and his assistant outside to immediately open the water-ballast tank valves and allow the ballast to discharge and drop the spuds, meanwhile to lock out the men in the working chamber, but this had never been necessary. There was ample storage in the air tank and working chamber to allow of this being done before the water level began to rise in the inside, this having been tested previous to use. Being built almost entirely of wood, the caisson could not sink altogether and a man could always dive under the lower lip if necessary.

The caisson requires three men inside, one engineer and fireman outside and an attendant who brings supplies, etc., as required.

A very common cause of accidents about a factory lies in slippery stair treads. This is recognized by many builders who recommend the use of treads having an insert of lead, carborundum, or other abrasive material. Some plants, however, are using a home-made stair tread. This consists of a channel iron with the flanges pointed upward, and the space between the flanges filled with concrete. Cinder concrete makes an especially good filling for these treads.

Better System of Highway Cost Keeping

By James J. Tobin and A. R. Losh* (Continued)

CERTAIN fundamental principles must be followed to make any cost system successful. This applies to road costs as well as to factory costs. Any cost-keeping system to be successful must be (1) reliable, (2) simple, (3) immediate, (4) flexible, and (5) relatively inexpensive.

(1) Reliability is of paramount importance. If the data collected are not reliable, all records based upon them, of course, will be misleading and the results dangerous. Accuracy is desirable, but this need not be carried beyond the practical limits adopted for measuring the units of materials expended and the units of work accomplished.

(2) If simplicity be not maintained the purpose of the system will be defeated. Involved and complex forms are confusing to the recording officials, difficult to compile for study and analysis, and apt to be inaccurate and a useless expense.

(3) To be effective, the cost records must be susceptible of immediate analysis and must reach the officials responsible for the economic progress of the work in time to be of use. If a week or ten days must elapse before wasteful methods and incompetency are discovered the information is past history and it may be too late to try other methods which might rectify the detrimental condition.

(4) Flexibility is very desirable. The system must be elastic enough to provide for the recording of all classes of work, irrespective of the size of the project, without any material change in the prescribed forms.

(5) Finally, the system must be relatively inexpensive. The cost of determining cost must be reduced to a minimum. If expense of obtaining cost records to point out the way to efficiency is not much below the saving effected, they have no just claim to a place in any plan of management.

The first problem in developing a cost-keeping system for highway work is to devise a general classification of expenditures that will conform to accounts appearing upon the ledger of the organization; that is, at the outset the cost keeper's records must tie into the bookkeeper's accounts. The ledger, it is well to recall, contains only as debits the funds received or appropriated and as credits the payments made from those various funds summarized from a record which carries the distribution of these expenditures according to subheadings or primary accounts. It is usual to classify accounts as far as possible by departments, or with respect to certain functions for which funds are provided. Such a classification of accounts provides the first division for the cost keeper. This division gives what usually are known as the general accounts. Numbers or letters are used to represent these accounts, and in these letters or symbols we have the beginning of a code for cost keeping. The following classification and corresponding letters show a departmental division of accounts and a letter code suitable for highway work:

General Accounts

C. Construction.—M. Maintenance.—R. Reconstruction.—P. Plant.—A. Administration ...

The first three of these, it will be observed, have to do with certain road operations. It will be found upon analysis that they consist of the operations necessary to produce or preserve road parts. A subdivision of these general accounts produces what are called the primary accounts. Such a division is shown below. The accompanying numbers give a development of the cost-keeping code:

C, M, and R. Construction, Maintenance and Reconstruction

00 to 09. Right of way.
10 to 19. Grade and roadside.
20 to 29. Roadway.
30 to 39. Ditches and drains.
40 to 49. Bridges and culverts.
50 to 59. Supplementary parts.
60 to 69. Engineering and supervision.

P. Plant

70 to 79. Plant accounts.

A. Administration

80 to 99. Administration accounts.

The numbers preceding the primary account give the range of class numbers for the final cost-keeping code. Thus 30 to 39 are the inclusive numbers for class costs of ditches and drains. This first division of the general accounts would serve very satisfactorily for a simple cost-keeping system. In such case the first set of numbers could be omitted and ditches and drains would be represented by 39 instead of the range of numbers from 30 to 39.

Primary Accounts and Class Code

C, M, and R. Construction, Maintenance, and Reconstruction

Right of Way
00 Preliminaries.
01 Right-of-way surveys.
02 Right-of-way plans.
03 Real state.
04 Damages.
09 Miscellaneous.

Grade and Roadside
10 Cuts and embankments.
11 Shoulders.
12 Berms and slopes.
13 Trees, shrubs, grass, etc.
19 Miscellaneous.

Roadway.
20 Subgrade.
21 V drains.
22 Sub-base.
23 Base course.
24 Intermediate course.
25 Binder course.
26 Cushion course.
27 Top course.
28 Surface.
29 Miscellaneous.

Ditches and Drains.
30 Ditches and gutters.
31 Ditches and gutters, paved.
32 Blind drains.
33 Tile drains.
34 Catch basins.
35 Drainage channels.
39 Miscellaneous.

Bridges and Culverts.
40 Foundations.
41 Abutments.
42 Piers and bents.
43 Superstructures.
44 Box culverts.
45 Pipe culverts.
49 Miscellaneous.

Supplementary Parts.
50 Signs and sign posts.
51 Monuments.
52 Guard rails.
53 Curbs.
54 Retaining walls and parapets.
55 Riprap and revetments.
56 Roadside treatment.
59 Miscellaneous.

Engineering and Supervision
60 Location and relocation surveys.
61 Surveys (for operations).
62 Plans.
63 Specifications and contract preparation.
64 Estimates.
65 Expense of awards.
66 Office expenses, engineering.
67 Supervisory engineering.
68 Inspection and tests.
69 Miscellaneous.

P. Plant and Equipment

70 Buildings, fixtures, and grounds.
71 Quarries, pits, material yards, etc.
72 Power tools and equipment.
73 Hand tools and equipment.
74 Livestock and vehicles.
75 Camp equipment.
76 Camp buildings and shelters.
77 Storage and transportation.
79 Miscellaneous.

Primary Accounts.

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*From Bulletin issued by U.S. Dept. of Agriculture.

A. Administration

80 Executive.
90 Maintenance of office.
92 Legal.
94 Clerical.
95 Fiscal.
97 Engineering, departmental.
99 Miscellaneous.

Primary Accounts.

Note.—It will be observed that no divisions beyond primary accounts have been provided under Plant and Administration. These can be expanded further to meet the requirements of the organization.

Operation Code

The next step is to develop a series of operations and a corresponding code which will include all the operations performed by the various departments to construct and maintain the works under their supervision. This may be accomplished in either of two ways. One is to list with each class of work all the operations that are performed under it. The other is to designate an operation by symbol and prefix this symbol with a class symbol, designating the class of work. By the first method such an operation as "rolling" would be listed under each roadway part and for both construction and maintenance. In the latter method, which is followed in this bulletin, "rolling" occurs only once in the operation code and the class code symbol is prefixed to give it the distinguishing classification. Thus any work can be indicated by combining a class code symbol and an operation code symbol.

The operation code consists of a list of descriptive phrases arranged alphabetically and designated by consecutive numbers following a dash or decimal point. This dash or decimal shows the linking together of the classification and operation codes. The operation code must include all operations necessary to be performed and the phrases must be limited to a single interpretation. The divisions of the primary and general accounts given previously form the class code. As these class code numbers represent road parts or departments of the organization, an accumulation of a number of operations for any particular road part or department is effected readily by grouping all of those having the same class number. Below is given a typical operation series for the general operations of construction, reconstruction, and maintenance of highways. A similar code could be devised for other operations.

The Operation Code

00 Assembling.
01 Back-filling.
02 Blacksmithing.
03 Blasting.
04 Building.
05 Building false work.
06 Cleaning.
07 Clearing.
08 Clearing and grubbing.
09 Cofferdamming.
10 Cribbing.
11 Curing concrete.
12 Crushing.
13 Dragging.
14 Drilling.
15 Drilling and blasting.
16 Excavating borrow.
17 Excavating common.
18 Excavating earth.
19 Excavating loose rock.
20 Excavating solid rock.
21 Excavating wet earth.
22 Filling ruts.
23 Filling washouts.
24 Finishing.
25 Forming.
26 General.
27 Grouting.
28 Grubbing.
29 Guarding.
30 Harrowing.
31 Hauling.
32 Heating bituminous materials.
33 Heating materials.
34 Laying.
35 Loading.
36 Loading and hauling.
37 Loosening.
38 Mixing.
39 Mixing and placing.
40 Moving.
41 Operating.
42 Oiling.
43 Painting.
44 Patroling.
45 Pile driving.
46 Placing materials.
47 Placing steel.
48 Planting.
49 Plumbing.
50 Plowing.
51 Pumping.
52 Quarrying.
53 Removing snow.
54 Repairing.
55 Riveting.
56 Rolling.
57 Scarifying.
58 Screening.
59 Shaping.
60 Spreading bituminous materials.
61 Spreading materials.
62 Spreading screenings, sand, or chips.
63 Sprinkling.
64 Stripping.
65 Tamping.
66 Trimming.
67 Washing.
68 Washing and screening.
69 Wasting materials.
70 Water-proofing.
71 Working on joints.
72 Wrecking.

Method of Obtaining Class and Operation Number From Code

To procure a code number for any unit of work it is first decided what class of work is under consideration, and a number is selected from the class table. Then the specific operation is sought for in the second, or operation, table. The two are joined together with a hyphen or dash. The code letter of the department then may be prefixed to the first number and the classification symbol is complete.

If it be desired to know the code numbers to be used for recording the labor of a man mixing concrete for use as a road top course the class number for a road top course first is looked up in the class code. This number is found to be 27; then the operating "mixing" is taken from the operation code and found to be 38. Joining the two together with a dash produces the full code symbol 27-38. The letter "C" prefixed would indicate construction work, while the letter "M" would indicate a maintenance operation.

Usually no classification letter will be used, but instead the capital letter "C," "M," or "R" will be shown on the recording form. If it be desired to know what code symbol to use in order to indicate properly the time of a man spreading bituminous material on a road for maintenance purposes, the letter "M" is set down first to show that the work is that of maintenance. From the class code the number for a surface is found to be 28. Preceding this number with a capital letter "M" gives M-28, which shows that maintenance work has been done on a road surface. Then there is selected from the operation code the number for spreading bitumen, which is found to be 60. The code symbol for maintenance work of spreading bitumen on a road surface then will be M-28-60.

Use of Code in Operations

In actual use the cost keeper generally would obtain his data from the timekeeper, who would be charged with keeping time and costs. A code for the use of the timekeeper would be prepared from the class and operation codes, which would have the advantage of being abbreviated and also properly arranged for the cost keeper's needs. Below is shown such a code, which was used on work where costs of the principal operations were desired, and also the expanded code, which was used where it was desired to make a more detailed study of operations for the purpose of efficiency.

Timekeeper's Code

Abbreviated.	Expanded.
(1)	Grade and Roadside.
19-17 Grading—rough.	11 Shoulders:
	56 Rolling.
	58 Shaping.
	19 Miscellaneous:
	07 Clearing.
	16 Excavating borrow.
	17 Excavating common.
	19 Excavating loose rock.
	20 Excavating solid rock.
	28 Grubbing.
	31 Hauling.
	35 Loading.

(2)
20-59 Grading—fine.
(3)
23-26 Base course—general.
(4)
23-34 Base course—laying.
(5)
23-56 Base course—rolling.
(6)
23-62 Base course—spreading sand and chips.
(7)
27-36 Top course—loading and hauling.
(8)
27-34 Top course—laying.
(9)
27-60 Top course—spreading bitumen.
(10)
27-24 Top course—finishing.

Roadway.
20 Subgrade:
  56 Rolling.
  59 Shaping.
  63 Sprinkling.
23 Base course:
  12 Crushing.
  31 Hauling.
  35 Loading.
  56 Rolling.
  61 Spreading materials.
  62 Spreading screenings, sand ,and chips.
  63 Sprinkling.
27 Top course:
  31 Hauling.
  32 Heating bituminous materials.
  35 Loading.
  56 Rolling.
  60 Spreading bitumen.
  61 Spreading materials.
  62 Spreading screenings, sand, and chips.
23-06 Cleaning base.

The timekeeper had only ten code numbers for general use, but where detailed costs were desired in order to determine relative efficiency and to eliminate wasteful methods 28 code numbers were used.

How to Lay Out and Cut a Strikeboard

Of the several kinds of strikeboards used on concrete road work where the pavement is of moderate width, probably the most efficient and simplest to operate is the narrow single type of strikeboard. This should preferably be made of well seasoned, clear lumber from 2 to 3 inches thick, 1 foot longer than the width of the pavement. If the lumber that must be used has a tendency to warp, it is probably better to bolt together two pieces of thinner lumber to secure the required thickness. The depth of the template should be not less than 12 inches, but 14 inches is preferable.

Mark the centre of the strikeboard and strike a chalk line across it at a distance above the bottom equal to the crown of the road. From this line, lay off the computed ordinates at intervals of about 1 foot.

Harger and Bonney's "Highway Engineers' Handbook" gives the following convenient method for computing the ordinates for parabolic crowns:

"Divide the distance from the centre of the road to the edge of pavement into 10 equal parts and call the total crown 1.0; the distance down to the surface of the pavement from the crown elevation at each of these 10 points expressed in decimal fractions of the total crown will be:

Centre of road—point No.	0	0.00
" "	1	0.01
" "	2	0.04
" "	3	0.09
" "	4	0.16
" "	5	0.25
" "	6	0.36
" "	7	0.49
" "	8	0.64
" "	9	0.81
Curb line " "	10	1.00

Figure 1 herewith illustrates the application of this method.

After the ordinates have been laid out and the strikeboard has been accurately cut, the bottom should be shod with a piece of 3/16-inch steel the same width as the thickness of the board. This should be fastened with counter-sunk screws 1¾ inches long every 12 inches. The shoe is bent up 3 inches at the ends and fastened.

Wood handles are placed at each end. The simplest method of attaching is to bore two holes 1¾ inches in diameter near top and ends of the strikeboards. Round hardwood sticks about 14 inches long are driven in these holes. A better way is to use two pairs of old plow handles bolted securely to each end of the board. This costs but little more and makes operation easier.

This is illustrated in Figure 2.

If the strikeboard is too flexible, it may be stiffened by nailing an inch board on top as shown in Figure 3. This adds but slightly to the weight of the board.

In manipulating the strikeboard it should be drawn back and forth across the road with a saw-like motion, at the same time moving it slightly forward. This should be done until a point about 3 feet from the joint is reached when the board should be picked up, moved to the joint and operated in the opposite direction.

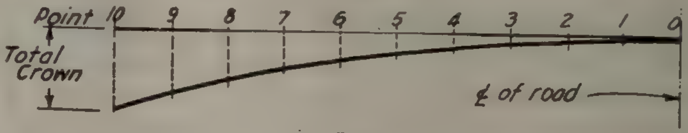

Fig. 1

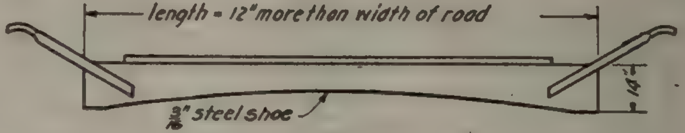

Fig. 2

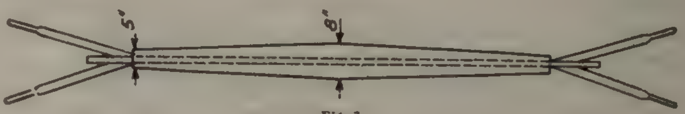

Fig. 3

If the crown is not full enough more concrete should be thrown in front of the strikeboard, at the same time making certain that the board rests securely at all times on the side forms.

Having struck the surface in this way, return the strikeboard to the beginning of the slab. Let one of the strikers hold his end securely on the forms while the other lifts his end a few inches and drops it in short sharp strokes, at the same time moving the strikeboard slightly forward at each stroke. After one end of the board has been moved two or three feet, the man at that end stops and the other laborer proceeds as before.

Following the strikeboard, the roller should be used to remove excess water. Final finish with a canvas belt will leave a dense, even, durable surface, capable of withstanding the heaviest modern traffic.—Concrete Highway Magazine.

If you want to please the Kaiser, give up the idea of buying a bond, and if you've bought some, don't buy any more.

Three Ontario municipalities, Sarnia, Brampton, and Sault Ste Marie, have taken up the provincial government's housing scheme. Others are expected to follow.

Firing Bituminous Coals in House-Heating Boilers

RISING prices of all fuels and the difficulty of obtaining the more desirable grades of coal are causing nearly all coal users to seek means of either reducing consumption or of burning coals obtainable at a lower cost. The following recommendations from Technical Paper 180, recently issued by the U. S. Bureau of Mines, may be of interest. These tests were conducted on low pressure or heating boilers that had heretofore burned anthracite coal, and are of the up-draft or surface burning type.

How to Burn Bituminous Coals Economically

1. In burning bituminous coals in large house-heating boilers, the fuel bed should not be seriously disturbed until the coal has become well coked, that is, until the gassy part of the coal has been largely driven off.

2. Both caking and non-caking types of coal may be used satisfactorily in boilers of this type if properly handled. (A caking coal is one that when heated swells and forms a solid mass).

3. The presence of a moderate proportion of screenings mixed with the lump coal causes the fresh charge of coal to heat more gradually and the emission of smoke is kept down more easily. Therefore, such a proportion of screenings is an advantage.

4. Increasing the proportion of screenings in the coal necessitates the use of a stronger draft in order to carry the same load. Smaller firing charges must also be used and more frequent attention given. The tendency of caking coals to cake is increased, and this also means that the fire must have more frequent attention.

5. Frequency of cleaning the fires will be determined by the character of the coal and the rate at which it is burned, but with most coals the fires should be cleaned only once or twice in twenty-four hours in ordinary weather.

6. If the alternate method of firing is employed (namely, if a fresh charge of coal is made to cover only one side of the bed) the side that is left bright will continue to radiate heating to the boiler, and will also serve to ignite the combustible gases driven off from the new charge.

7. The average man is apt to poke and slice the fire much more than is actually necessary. If a caking coal is used and the caked fuel must be broken up before it is well coked, slice the fire by running a straight bar under the fuel bed and raising it slightly so as to crack the caked mass. Do not stir the bed upside down by raising the bar through the fuel bed, nor break the bed with a bar from the top.

8. If the fuel bed is covered with a charge of fresh fuel in a layer more than five inches thick, the new charge, unless it is very free from slack, is apt to have a smothering effect. Then the output of the boiler will be correspondingly decreased and, especially if the spreading method of firing is employed, the mass of fresh coal will usually have to be broken once or twice before the fire will pick up. Consequently, the maximum firing charge should not be much thicker than five inches, and for caking coals containing considerable slack, it should not be more than four inches thick. Of course, when a fire is to be kept banked heavier charges may be used.

9. Do not fire large lumps of coal. Break all lumps into pieces no larger than fist size.

10. Large house-heating boilers do not require an intense draft to meet any reasonable demands for heat if the fuel bed is kept in proper condition, but the draft must be properly controlled.

11. The damper regulator should work freely.

12. The doors on the front of the boiler should fit snugly in their seats; special care should be taken to prevent any material wedging between the doors and the front and thus admitting air when or where it ought to be prevented from entering.

13. Do not allow clinkers to accumulate in the fire or too great a quantity of ashes on the grates. Be careful, however, in shaking the grates not to shake through unburned fuel.

14. In ordinary or severe weather, keep an active fuel bed averaging 10 to 12 inches deep. In milder weather, the depth of active fuel may be decreased by keeping a layer of ashes on the grate under the live coals.

15. Keep ashes removed from the ash pit.

16. Keep flue surfaces clean by brushing at least once a week.

To Meet After-War Conditions

A delegation representing the Canadian Manufacturers' Association, the Canadian Industrial Reconstruction Association, and the Toronto Trades and Labor Council, recently came before the Dominion Government to urge measures to meet after-the-war conditions. The particular point under discussion was the creation of an export committee to co-operate with the government towards the extension of Canadian export trade when hostilities cease. With the closing down of munition work, it was pointed out that new fields of industry must be opened up to take its place. As a result of the conference it was decided to form a committee representing the manufacturers, agriculturists, and organized labor, to deal with the problem in conjunction with the government. Arrangements are to be made in the near future for effecting the necessary organization through which these interests may act, and the Reconstruction Committee of the Cabinet will co-operate in the scheme.

To Get Timbers Into Position

A wire stretcher, such as is used by farmers in stretching barbed wire is a convenient tool with which to pull stubborn timbers into position.

To use the stretcher it will be necessary to have on hand a few feet of strong barbed wire. Select that in which the barbs are firmly interwoven with the wire. Fasten one end of the wire to the timber to be straightened, the stretcher to an opposite timber that has been securely braced. Attention to this latter item is a prime essential. The stretcher may now be operated in such a manner as to draw the warped timber into alignment. This accomplished the latter should be securely braced.

A convenient and simple pocket screw-driver can be made from a triangular piece of steel. This should be about 3 inches across and ⅛ inch thick. The points are cut off and brought down to the thickness of a screwdriver, the three varying in size, thus offering instantly the proper-sized blade for each ordinary size of screw and providing a leverage entirely out of proportion to its size. It will be well to round off the edges between blades, and temper the blade points.

War Engineering in Mesopotamia

An Interesting Description of the Daily Life of a Young Canadian Engineer and His Company of Sappers on the Tigris and Euphrates

[Some time ago we printed in the Contract Record two or three very interesting letters of Lieut. L. W. Wynne-Roberts, son of Mr. R. O. Wynne-Roberts, describing his trip to India. After several months in India, Lieut. Wynne-Roberts left Bombay last January, and has since been located "somewhere" in Mesopotamia, where his engineering training has been utilized by the British Empire, chiefly on bridge work. Fortunately for his family, Lieut. Wynne-Roberts is a regular correspondent, but to the most casual reader his letters are full of a human interest which is always associated with a diary of a man having a keen intelligence and something to say. Through the kindness of his father we reproduce extracts of numerous letters received during the first six months of the present year.—Editor.]

Basra, Mesopotamia, 16 - 1 - 18.

Monday morning gave us our first glimpse of Mesopotamia and all we saw were avenues of date palms marking the banks of the river, with miles of swamp beyond. And the temperature! Well, we were mighty glad to don cardigans, serge tunics and British warms when we went on deck. The natives fared worse as they intensely dislike cold, and it was a common sight to see a man wearing a Balaclava cap surmounted by a topee or a pugaree, whilst he covered his body with every article of clothing issued to him.

Basra is some 60 miles from Fas, and we enjoyed a pleasant five-hour trip up river, seeing palms all the way, and noting with interest the amount of shipping en route.

We slowed down as we were passing Aberdan, the centre of the ore distilleries or refineries, and the home of the Anglo-Persian Oil Co. We spotted the refineries a long way off by their chimney stacks, and when a little nearer the pungent odor of crude oil made itself apparent. The possession of these oil wells must mean, and have meant, a great deal to the operations here, as nearly all the river craft are run by oil or petrol.

Twenty miles from Basra we came to Muhammarah, which was the scene of an encounter in the early days, and is chiefly noted by river passengers nowadays for the Sheik's palace on the river front—a magnificent building.

A mile or two further on we reached the spot where the Turks made an ineffectual attempt to block the river by sinking two ships. The masts and funnels of these boats are still above water and they make no difference to the traffic as the deep channel swings outside them.

Basra itself is a regular surprise packet! One expected to see every body busy, but never thought it possible to see so much shipping activity in one river. We disembarked at Magill—six miles from the point where the harbor master boarded us—and we passed nothing but ships all the way.

We are some three miles away from the city itself, and our quickest way in is to walk. The city and suburbs have numerous creks running through them—Ishar creek, Robart creek, Whiteley creek, etc., which lead to the river. One can travel along these waterways by means of "bellums," a kind of gondola propelled by two Arabs, one in the stern, with a paddle, and one in the bow, with a pole. They go slowly, and always keep in the shallow water—rather necessary, as the river has a 45-foot channel here.

The Arab is a most dirty looking specimen, clothed in old S. & T. sacks or discarded clothes of the troops. He wears about five pairs of socks, each successive pair being whole in the places which cover the holes in the sock beneath. He wears a shawl on his head, which is held down by a kind of crown of rope, which fits on to his head.

The Arab woman is quite good featured—some of them very fair skinned with dark eyes and brows—and cover or uncover their faces as they feel inclined. Like the Indian women, they disfigure themselves by wearing rings through their noses, and, like the male specie, look as if they washed only on very special occasions.

Mesopotamia, 5 - 2 - 18.

One of our numerous little jobs is to maintain traffic over a bridge constructed of native boats. To-day it is raining hard and half a gale blowing. Judge how we enjoy ourselves getting thoroughly wet and trying to keep the bridge from getting away whilst other boats—"dhows' and "bellums"—continually bump us, essaying to make for the "cut." The bridge is "cut" once daily and a large number of boats pass through, as the river is now open for some distance north of our positions.

Our company at present is on a little stunt of its own—reconnoitring—and having a more or less happy time—chief trouble being a few raiding Arabs.

Mesopotamia, 23 - 2 - 18.

The particular bridge which we look after—some 700 feet long—is a regular trap. Such a large number of people walk gaily on to it, thinking that there, at least, they could get a footing, and in less than no time, they spread their lengths along the ground. Highly amusing for a spectator!

Mesopotamia, 2 - 3 - 18.

Apparently we have had enough rain—seven days pouring out of a possible nine, is not at all bad going, is it ? Just imagine how pleasant to be in a tent and having to walk through miles and miles of slippery, slimy slush in order to get your meal, and then coming back again.

The approaches to the boat bridge got into a very bad state, and numerous people fell and slipped down. It was amusing to listen to frantic transport drivers using violent and vulgar Hindustani, trying to urge their mules through water which reached up to their stomachs, and still more to meet a camel train absolutely unable to stand on their legs. A camel is useless on slippery ground—its four legs go like this >–<; and for sheer obstinacy!

Mesopotamia, 23 - 3 - 18.

Between the rapid rise of the river necessitating a constant watch upon the boat bridge and its approaches, the loading of a flying bridge and other road bridges on to a boat to be taken to another point on the river, and certain urgent doings of the company itself, we are fairly run off our legs.

Mesopotamia, 27 - 3 - 18.

I am once again on the move, as we are changing our position to another front (in Mesopotamia). We have had to come right back to Basra to do so, and are now in camp there awaiting transport boats to take us up to Bagdad and beyond. It should prove to be a very interesting trip.

"On the Tigris," 1 - 4 - 18.

We embarked on Good Friday on a "P. S." boat (paddle steamer) which is towing up two barges alongside—one carrying mules and horses and the other, all the Indian ranks. We are very lucky on board this boat, as there are just sufficient cabins to go round (two in each) and we get our messing on board.

The first couple of days were glorious, but last night we struck rain and to-day everything and everyone is abominably wet.

The river where we are now is quite wide and navigation easy, but 36 hours ago, when we were passing through the narrows, our progress was a series of bumps from side to side.

The inhabitants of the villages en route, knowing where the boat and barges always got very close to the bank, used to line this bank with their baskets full of eggs and poultry, which they sold to the troops. At one point we "banked in," waiting for another boat to pass, and here the Arab women walked up to their waists in water in order to sell their goods.

As the river is very full and within an ace of overflowing its banks, one can just picture the trials of the troops, two years ago, as they made their valiant attempts to relieve Kut.

Tuesday, 2nd.

We arrived at Kut about midnight—rather a pity as we couldn't see all we would have liked to. Shall probably see more of it on some future occasion when going down river again.

To-morrow morning, early, we should be passing the famous arch at Ctesiphon, and about 11 a.m. will arrive at Bagdad, where we shall disembark and probably go into camp for a day or two before moving on.

Mesopotamia, 18 - 4 - 18.

We had three more days in Bagdad after I last wrote to you and were anticipating moving off in three more days' time to a certain place—transport and everything else arranged.

But suddenly, late in the afternoon, comes an order for a British officer and a detachment to leave in an hour's time to a place totally different to the one first thought of.

Then some hustle! Detachment sorted out, tents struck, equipment selected and rations drawn, and off I went with the detachment and a string of carts following behind.

From the station we went by train and at midnight landed at our destination and were dumped out bag and baggage into the dreariest spot in the Mesopotamian desert! It posseses only two things—this to my certain knowledge—a river and sand, and lots of the latter. Why, during the night, last night, everything in my tent got covered with a layer of sand ⅛-inch thick and I felt like an Egyptian mummy, all plastered up.

Well, we had to pitch our tents by starlight on the first available spot not already occupied, and we were very pleased to get to sleep.

I had a very busy day aferwards settling everything and arranging for a host of odds and ends before we could get to the real object of our arrival here.

Our stunt this time is going to be an interesting one and also a trying one, and without violating censorship rules in saying so, it amounts to collecting, or rather complete collecting, as most of it is here—nearly 500 tons of bridging materials; make our own rafts of anything we can and then float away by water to wherever our orders are. Considering that among the stuff here there are more than one hundred rolled steel joists, 10 in. x 5 in., 25 to 30 ft. long, methinks I have my task cut out, and we shall be lucky if we get through without losing a raft or two. Our water route is over 300 miles, that we know. So when I have completed this I shall be expert in rafting.

Mesopotamia, 25 - 4 - 18.

On two nights I have been very rudely disturbed by having the sides of my tent blown in. We seem to get very sudden winds here and, believe me, you know it. Your tent's sides are blown in or otherwise useless, and you are smothered in dust.

Yesterday was a very rough day. It started to rain in the early morning, dried up by 8 or 9, and by 11 there was a furious dust storm. Considering that all the country is pure desert, you can imagine how much sand gets carried around, and most of it seems deposited on one's person or in one's ears and eyes and mouth.

I had to go and meet a party of sappers who were coming to join me and I'm certain I couldn't see forty yards ahead of me. Forunately I had a pair of dust glasses with me and I and many others who wore them must have looked a sight with huge goggles over our eyes.

One day last week I was over on the other bank of the river, and as it began to rain very heavily I took shelter under a wall of a large house. The owner saw me and invited me in. I went in and found myself being introduced to an Armenian family. They spoke Arabic, Armenian, Turkish and French, and I had to rake up my rusty French to try and converse with them. The family were brought in one by one, and I had to greet them all. I got on fairly well and have ben invited to go there again. I had coffee first of all, then cigarettes, then tea and cake, more cigarettes and then more coffee—altogether I stayed there about two hours and then they rowed me back across the river.

Mesopotamia, 2 - 5 - 18.

We are having our hands full and the detachment has been further augmented by 50 sappers. A lot of our bridge boats, wherewith we make rafts, sink during the night, and we have a fearful time next day recovering the sunken boat. All the boats are "jeered" or have a covering of bitumen which makes them very heavy, and which cracks very easily and peels off in the hot sun, adding further to our troubles.

To make it still more pleasant, a party of sappers who were towing a raft upstream, yesterday, lost the tow rope, and away went the raft and a number of other sappers on her down the middle of the river. By chasing after it in a launch and getting the rope I persuaded the raft to work towards the shore, and about two miles down stream we got the boats in. Then we started to tow back and I'm blessed if a mahela (an Arab sailing boat) out of control, didn't bump into us broadside and sink the whole "caboodle." It took 25 sappers two whole days recovering these boats in ten feet of water, and the owners of the mahela will have a tidy little fine to pay and damages to stump up for.

This morning at 6 a.m. the night guard reported all correct regarding our boats. At 7.15 a.m. we looked for a certain boat and found it had gone. Mr. Arab, if you please, wanted to cross the river and promptly helps himself to our boat, pushes out into the stream and drifts down wherever the current will take him. We saw this gentleman "boosting in the blue" as they call floating down mid river. He, too, was caught up and got a good hiding. The Arabs, of course, will sneak anything. I've heard of men sleeping in a tent and having everything removed, including their blankets, and excluding their bed, whilst they slept.

Another "Where" in Mesopotamia, 6 - 5 - 18.

I have now resumed military duties having been Admiral of a fleet of forty-one boats for four days.

In my last letter I told you we were very busy making preparations for moving, and that I was taking down some 150 men and 41 boats to be used for bridging. We got away early on the Saturday morning and after a trying, sometimes dangerous, but withal pleasant trip, reached this place in four days, which is record time. Another officer left some time ago with only fifteen boats and took six days.

I naturally took my launch along with me, and with its aid was able to pull and push boats off sandbanks and rescue sundry sappers who were stranded on shore, and were wearily making their way along the bank. There is a tremendous current in the river, but also a prevailing wind which persists in running boats in on the left bank. When this happened, a sapper used to jump off into the water and push the boat off. Before one could say Jack Robinson, the current would catch the boat, away she'd go at an awful pace and there was the sapper in the water, much surprised at everything.

Our first days' trip was very difficult as we had to pass through the barrage. It took us six hours to pass 41 boats and then we had to tow them adong a concrete revetment for 100 yards. Then came the crowning point—we had to get through a 20-foot channel between submerged portions of the Turkish barrage, with water swishing through it, the limits of the channel unknown—only vaguely pointed out from shore, and a high wind. Talk about hair-raising thrills—I had my fill during those two hours.

You must remember these boats are only roughly framed and the outside covered with bitumen, which is damaged very easily, and once cracked or broken, the boat fills immediately. Well, six of the 41 found the submerged portion, came an awful crack on it, took in water, and I had a big task getting them to shore. Eventually I had to carry them down slung between two good boats.

I'm here to put in a bridge of span 450 ft.—nothing difficult about it, only a lot of odd jobs to be done first, such as shifting ferry, etc. I have fourteen days to do it in and hope to finish well ahead of time. Our trouble—if any—will be the placing of 5 cwt. anchors in their correct positions—they are clumsy things to handle.

I am within nine miles here of a very famous place for pilgrims—you can see its large mosque and dome miles away over the desert. I have travelled over 800 miles since middle of March, all by river—by paddle steamer, bellum, mahela, gurfa, and bridge boats.

Mesopotamia, 9 - 5 - 18.

I don't know if I told you I had made a kind of flying bridge here. I stretched a cable across the river and worked a mahela (an Arab boat) across on it, guiding the wire on the boat by means of pegs. The idea is to incline the boat sufficient by these pegs and wire so the current impinges on it and sends us across. Excepting at the banks there is no pulling by the men and the boat makes the crossing of about 200 yards in less than 10 minutes. Before I finish this job I shall be quite expert at these stunts.

Mesopotamia, 23 - 5 - 18.

I am now eighty miles from the place I last wrote you, having received urgent orders to move. So we got away by river in a very few hours, and after a day's trip on the river, reached ————, where most of our company have concentrated preparatory to pushing off elsewhere.

Last Friday I met the Divisional Commander and had to act for my O. C., and give such information as I could, which has resulted in this movement. Now we're off to make two very large bridges—I have charge of one—and as soon as I get it done I have to get on with a "demolition" stunt in a certain place which has been misbehaving itself, so I am sure to be amply employed during the coming month or two.

Mesopotamia, 31 - 5 - 18.

I seem to be getting more and more work each week and this past week has been a particularly hard one. To-morrow morning at daybreak I am on the move again, taking some 41 country boats (made like pontoons) to their bridge sites, 50 to 60 miles away. I have 129 sappers under me for this purpose and, in addition, I am getting a host of Arabs to help.

When we get there I then have the job of putting the bridges up, but I don't thnk we can make the trip under three days.

To get to our destination we have to pass through the barrage erected by Sir John Jackson on Willcox's advice, and also get around the old Turkish barrage, which is the worst part, as this collapsed in a flood, and now there are many jagged edges of masonry sticking up in the river. However, we shall pass that alright I'm sure, and get to our destination without mishap. In addition to a flotilla of 41 boats, I have three "gufas," whose patents must have been taken out 2,000 years ago, as they are the identical pattern of those used then. We pass quite close to the ruins of the Tower of Babel, and when we return—in about six weeks to two months' time—we may come to rest at the site of old Babylon.

This place might well have been the site of the Garden of Eden, as there are numerous gardens, and by a little persuasion, one can get apricots, plums, nectarines, pomegranates—unfortunately we leave tomorrow.

Mesopotamia, 13 - 6 - 18.

It's a week since I last wrote you and it seems like two days, so busy have we been and so little seems accomplished. I have exactly one more week in which to make my bridge across this Euphrates—if my boats don't give up the ghost meanwhile I can do it and with time to spare. The boats being covered with bitumen, this bitumen blisters and cracks in the hot sun, and water gets in, when I begin to swear, as we then have to manhandle a 2½-ton dead weight, get it on shore and upturn it for repairs.

Mesopotamia, 20 - 6 - 18.

Well, I'm through with my bridge I have been building, having brought boats and materials 150 miles by river; we got through one day ahead of time, and were carrying traffic very successfully yesterday. Everybody here—who will be using the bridge—is pleased with it and it looks very good.

Our O. C. is busy putting up another brdge eight miles away on another branch and this is a heavier one, carrying R S joists as road-bearers. So far not much progress has been made, and he goes on leave in a few days' time and I am taking his job on, and completing the bridge. At the same time I have to construct two ferries, some 30 odd miles away, so my work is by no means through yet for this summer.

I have another detachment at a town a few miles away who have been carrying on demolitions. I went out to see them on Sunday and had an interesting time. It is a famous place—wish I could give it a name—second only to Mecca—and no one allowed inside the city walls. Our work is inside the city and as a sapper officer superintending work, I was privileged to enter. The city is like any other eastern city as far as I could see and one could get glimpses of the wonderful mosque with its golden dome and minarets, which we could see 15 miles away when coming down river. In normal times pilgrims enter by the thousands, mainly from Persia, and a huge dominating building, known as the Pilgrim's Khan, was erected by a philanthropist. Unfortunately when a disturbance occurred in the city the ringleaders and their following would go into this building and dominate everything; so it was closed. I went up on the roof and could see the house-tops, etc., below me.

Outside the walls are two huge mounds of earth, and it is said these are the outcome of the hundreds of cellars within the city. Every house has tier upon tier of cellars, to which they retire in hot weather, and every house a well 100 to 150 feet deep. In our work we met with many of these and I myself tried the depth of one well and found it 130 ft.

Outside the walls is a large graveyard and here the pilgrims bring their dead, with their feet pointing to Mecca.

One wonders why such a pilgrim city should be built in mid-desert, and the legend of its founding is interesting also: In the days of old, Harouan Alhasbid was in this city in which I am now staying, and set out one day across the desert, followed by a large retinue of servants, etc. Some 9 miles out, in a place of no trees and no water, his camel stumbled and Harouan came an awful cropper. To save his face he exclaimed "Behold, this is where Ali the prophet is buried, and right away a tomb and mosque were built, to which the pilgrims come to pay reverence.

I've seen the ruins of Ur of the Chaldees, of the Tower of Babel, of the (supposed) tomb of Adam, of Ali the prophet, and in a month or so, shall be within four miles of Babylon, so I am seeing something.

Mesopotamia, 27 - 6 - 18.

Mesopotamia is certainly a land of the future, and if one were in the "politicals" or an "Irrigation" officer, one might have a look-in at some of the jobs when peace obtains.

The irrigation question is very interesting and I have been fortunate to have been located in one of the most highly irrigated areas of Mesopotamia.

The name Mesopotamia means the land between the two rivers, and right central lies the ruins of old Babylon, to whose neighborhood before many weeks I hope to be taking my part of the company. In the days of old the Euphrates used to run past Babylon when that city was at its zenith but the river found a new channel and the old channel started silting up, and as Bablon lost its prestige, so did that part of the country become dry and arid and remained so, I suppose, for centuries.

With the coming of modern ideas, the Turks conceived the notion of putting a barrage across the Euphrates, just below the site of the old channel, gathering a head of water and so forcing it down the path of least resistance, down its channel past Babylon. (I wish I could mention the present-day names of places, but it mighn't please Mr. Censor).

This barrage did not last long long, got broken up by high floods, I believe, and now there remain nasty rugged pieces of masonry, some showing above water, most of them unseen, through which a mahela or any other craft must take its chance, and this is the place, as I told you in a previous letter, I had all the thrills when bringing my own flotilla of 41 boats downstream. Up high on the left bank has been built a monument of a kind—sort of obelisk with Turkish inscription.

Following this breakdown, I believe, Sir Wm. Willcox came to the country in an advisory capacity, and a new barrage was built 500 yards upstream of the old and a new channel or canal was cut to lead from the river to its old bed. The passage of the barrage is made by means of a double lock, 8 metres wide, whilst to the canal there is only one gate to be lifted.

I believe the barrage was completed in 1912-13 by Sir John Jackson & Sons, and is not a pretty thing to look at. Wilcox himself said that it was designed and constructed for a poor country. That it worked well before the war and during the Turkish administration, is evidenced by this fact: When the Turks left the area they would have greatly loved to blow up the barrage, but they had no explosives to do it with, and so tried to damage it by closing all the gates and jamming them so that the water would gain a head greater than that designed for and so make its own destruction. With the departure of the Turks, the Arabs viewed with dismay the accumulating water, and for their own interest only (they were more or less hostile to us) tried to open the gates. Failing to do this they cut channels through the banks and allowed the water to get downstream—war or no war, they had no intention of being deprived of the benefits of the barrage.

The war is at critical stage—Buy more.

Mainly Constructional

East and West—From Coast to Coast

The Dunford Bungalow Builders, Limited, has been incorporated with a capital of $10,000, head office at Victoria, B.C.

Cloutier, Limitee, is the name of a recently incorporated concern, which is authorized to carry on business as builders and contractors. The firm's head office is in Montreal and their capital $20,000.

The Winnipeg aqueduct, which is now connected up from the McPhillips street reservoir to Shoal Lake, covers a distance of 100 miles. The tunnel under the Red River is not yet complete, however, and the whole pipe will have to be cleaned.

The Wild Horse Dredging Company, whose headquarters are in Seattle, U.S.A., has been registered as an extra-provincial company in the province of British Columbia, with offices in Victoria. The firm's capital is $100,000, and it is authorized to engage in the business of a mining, smelting, milling and refining company.

The Grand River Railway Company propose to move their tracks between Preston and Hespeler, Ont., further south, in order to straighten the line and also avoid the floods to which it has been subject from the River Speed. Work is being started on the clearing of the timber off the survey, and the grading of the line is to be commenced as soon as possible.

R. T. Gilman & Co., Montreal, have purchased the 60-lb. rails of the London & Lake Erie Railway & Transportation Co., whose road has been scrapped. The rails are being sent to Japan. It was suggested that the line should be purchased by the municipalities in the districts affected and operated in conjunction with the London & Port Stanley Railway, but the plan fell through.

The C. P. R. proposes the extension of its yards at Windsor, Ont., at a cost of some $100,000, plans for the undertaking having already been approved. A new shed is to be erected with a capacity of 18 cars and tracks laid to accommodate 40 cars. Property has been acquired between Sandwich and London streets opposite the present sheds and east of the tracks now in use.

At a recent meeting of the fire, water and light committee of Winnipeg, Man., Fire Chief Buchanan brought up the question of the construction of film exchanges, urging that all buildings used for this purpose be made absolutely fireproof, and of one storey only, owing to the inflammable nature of the films. As a result, a resolution was drawn up embodying regulations and restrictions as to the type of structure put to such use.

At a luncheon in New Westminster, B.C., given in honour of Hon. Martin Burrell, Minister of Mines, Secretary of State, and British Columbia's representative in the Dominion Cabinet, the question of establishing the British Columbia section of the proposed trans-Canadian highway was brought up, and the Minister promised the movement his support. Senator J. D. Taylor, who introduced the guest, explained that the highway wanted was one commencing in the locality of New Westminster, passing through Mr. Burrell's constituency and thence through the rest of Canada. The proposition was that the provincial government should seek the aid of the Dominion government and that an appropriation be made under the Highway Improvement Act.

As regards paving work required to be done during 1919, in St. John, N.B., Commissioner Fisher reports that the following streets are most in need of paving, and advises that the method of payment for the work should be by bond issues, the term of such issue to be fifteen years, and the annual charge for interest and sinking fund about 11 per cent.: Union street, from Waterloo to Brussels, granite blocks on concrete base, about 1,300 square yards, cost about $8,000; Union street, Dock to Prince William, granite blocks on concrete base, 2,000 square yards, $12,000; Water street, Duke to Reed's Point, granite blocks on concrete base, 4,700 yards, $30,000; Prince William street, Princess to St. James, granite blocks in track section with asphalt on both sides, concrete base, 6,500 yards, $38,000; Germain street, King to Union, asphalt on broken stone base, 1,600 yards, $6,500; Princess street, Germain to Charlotte, asphalt on broken stone base, $5,500; Duke street, Germain to Charlotte, same as above, about 1,300 yards, $7,000; Douglas Ave., whole length, asphalt on broken stone base on sides of street, no paving in the track section, about 18,700 yards, asphalt, $86,000; City Road and Haymarket Square, same as above, 16,000 yards, about $73,000; total, about $266,000, including a large amount of granite curbing and some expensive grading.

Personals

Mr. F. J. Bisaillon, K.C., of Montreal, has been named by the government to succeed Mr. P. B. Mignault, as a member of the International Waterways Commission.

Hon. Geo. P. Graham, of Brockville, Ont., has been elected vice-president of the Brockville House Building Company, which has formulated a scheme for solving the housing problem in that city by erecting homes for working men to be sold on the easiest terms.

Mr. C. B. Sissons, secretary of the Ontario Housing Committee, states that a report on the situation will be submitted by January, as originally planned. The judging of the 36 essays on the solution of the housing problem, submitted before September, is still in progress and the decision as to the prize winner will shortly be announced.

Lieut. L. L. Johnston, M.C., has been appointed District Vocational Officer of the Department of Soldiers' Civil Re-establishment, for the province of Alberta, succeeding Mr. J. F. Royce, who has resigned. Lieut. Johnston is a mechanical and electrical engineer and has had a great deal of experience in construction work both in Canada and the United States. Prior to the war he built Spence's Bridge across the Fraser for the C. N. R. Since his return, he has been working as a field officer for the Re-establishment Department in British Columbia, surveying the industries in that province in search of openings wherein disabled soldiers might be trained.

Obituary

The death of Mr. Alexander Mills, of Ormstown, P.Q., is announced. Mr. Mills owned and operted a brick manufacturing plant in that town for nearly thirty years.

Mr. Chas. R. Lavelle, secretary of the St. Marys Cement Co., St. Marys, Ont., died recently as the result of an attack of influenza. Mr. Lavelle, who was born in Durham, Ont., was in his 38th year.

Mr. W. F. Cowan, president of the Standard Bank of Canada, who died recently at his home in Oshawa, Ont., was also president of the Oshawa Malleable Iron Works. He was in his eighty-eighth year, having been born in Ireland.

Mr. W. Fraser, of the Eastern Eqipment Co., Montreal, has received word of the death of his only son, Signaller C. R. Fraser, killed in action. He went overseas with a Canadian siege battery in June, 1917.

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Who is Looking After After-the-War Trade?

THE events of the last few days in the war areas of Europe have driven home the necessity for prompt action regarding after-war activities.

What will industrial conditions be in Canada three months after the close of war? Presumably all war orders for munitions and contributory materials will cancel themselves automatically with the signing of peace. What will occupy these immense plants? Where are the orders to come from that will provide a living wage, not only to the workers at home, but also to the extra half million that will have to become re-established during the following eighteen months?

It seems to be accepted as a fact that the largest and most immediate demands will be those of devastated France and Belgium. It is reasonable to anticipate, also, some little delay in getting construction work under way here at home. Isn't it clear then, if we are going to keep our industrial plants going and our workmen employed, that we must get after the overseas business?

One would like to feel that our government has its finger on the pulse of the situation and would initiate such action as is necessary to meet the case. However, governments rarely act except under pressure from the electors, and in this case it is reasonably certain that if we, as Canadians, want to continue our manufacturing, engineering and contracting industries in their present state of activity, the men engaged in the industries must themselves take the first steps. They must take the lead and it is reasonobly certain that the government will follow and give all necessary assistance.

There is evidence that certain "captains of industry" are more or less awake to the urgency of the situation, but this cannot by any means be said of all of them. Such activity as has been displayed, for example, by Hon. Frederic Nicholls, is the exception rather than the rule. Of course Mr. Nicholls has had a unique opportunity, in the Senate, of placing his views before the government and the country, but it can at least be said that he has been quick to take advantage of his opportunity where others have remained silent. Then, a considerable amount of propaganda work has been carried on by a Canadian Committee on Franco-Canadian Trade Expansion, with headquarters in Montreal, and finally, as reported in our last issue, there has been the delegation of representatives of the Canadian Manufacturers Association, Canadian Industrial Reconstruction Association, Canadian Trades and Labor Council, etc., waiting on the Dominion Government to urge measures to meet after-the-war conditions.

The Department of Trade & Commerce from now on bids fair to be the most important department at Ottawa, and if Canada is going to hold her own, has no need for a professional politician at its head. What is needed is a hard-headed business man, quick to see the possibilities in Canada's overseas trade, ready to lend his ear to the appeals of the men who are behind these industries, for co-operation and assistance. It is a situation that calls for prompt and united action.

Conference of Canadian Building Industries

IN a couple of weeks the conference of Canadian Building Industries at Ottawa will be proceeding. This is an event of the utmost importance to Canadian contractors and dealers. It presents a great opportunity and, at the same time, points out an urgent duty—the opportunity of improving conditions in, and raising the status of, the contracting business, with a resultant pecuniary benefit to each individual connected with it, and the duty of building up Canadian industry and promoting Canadian interests by co-operative effort through a definite organization. We would therefore urge most earnestly that every contractor and supply man whose business or private affairs does not render it impossible, attend this convention, and that all, whether or not they can be present, lend the movement their heartiest support in the meantime. Every town and city should be represented, from the Atlantic to the Pacific.

It is not necessary to point out to Canadian contractors what the ills of their industry are. They know them only too well, but some have come to look upon them as inevitable, while others, in the enthusiasm and vigor of initiation, believe they can overcome them by individual effort and that they need neither give nor receive assistance. Both attitudes are wrong; there is no place for resignation in the business world of to-day, and the "independent" idea, old-fashioned and outworn as it is, has long ago been proven a detriment to progress in every walk of life.

What is necessary for the success of the conference and of the general contractors association which it is suggested may be formed, is that interest and enthusiasm be aroused throughout the country. Contractors have knowledge enough and experience enough to form a first-class organization, if they will only get together. The main difficulty is in working up the spirit of co-operation; for a trade organization is practically worthless unless it has the support of the majority. What would the labor unions have accomplished did their membership not represent the majority of the membership of each trade? Just consider what measures they have been enabled to take owing to their great numerical strength! Cannot the contractor who is continually confronted with labor's demands, learn something from labor's methods?

It is particularly desirable that young firms, with their new ideas and modern outlook, should take hold of this thing and inject into the organization a life and vigor that will make it worth something. Doubtless many have remained outside existing associations because they have considered these are being run on narrow and cheap lines. The lack of your support, your ideas and your personality is the very reason of their seeming failure. There are faithful members who have stuck by the Builders' Exchanges through long years, spending considerable time and money in connection with them, and who have received little returns for their efforts because they had not sufficient support. No association will thrive for long without the infusion of new blood, and this explains the failure of the Exchanges in many of our towns and cities. It is now suggested that the Exchanges be made the foundation of a general contractors' association, a step which should long ago have been taken and which should lead to big results. The results, indeed, are assured, if contractors will only make the necessary effort. Don't hang back and leave it to the other fellow. Help the organization, and you will help yourself.

City Engineer Doane Proposes to Control Design of Halifax Buildings

CITY Engineer Doane of Halifax has made a recommendation, which has been unanimously approved by the city council, that an amendment to the Building Act be sought at the next session of the Legislature, providing that the building inspector shall have the power to reject the design of any building submitted by a prospective builder and that he shall have the power to compel such builder to substitute therefor either a design selected from those on file in the building inspector's office, or one prepared by himself as the building inspector might approve. His further suggestion that copies of the designs used by the Halifax Relief Commission be secured, and kept on file by the city for the use of builders, also received full approval. In this connection, his report stated:

"Intelligent designing does not necessarily mean any considerable increase in cost, while it means an immense increase in the satisfaction to the purchaser, and a corresponding improvement in the general appearance of the city. If the building department of the city had some discretionary power so that they could prevent the erection of ugly structures immediately adjoining or in the vicinity of handsome and pretentious structures, it would be a desirable step in advance. The Halifax Relief Commission has a varied assortment of designs, prepared by architects of standing, all pleasing in appearance and many of them comparatively inexpensive. I am satisfied that I could obtain a copy of these designs on application; some of them have been filed already in this office. The great majority of the house builders with limited means would be only too pleased to get the assistance of this department, if it did not add very much to the cost of their construction; and even though the city had to pay for the designs I think it would be money well spent if a large number of designs were on file in this office for selection by prospective builders."

Good Roads Competition in Saskatchewan

THE awards in connection with the second annual road competition instituted by Robinson, MacBean, Limited, of Moose Jaw, Sask., in the section of the province in which that city is located, have recently been made. The company's efforts in good roads' promotion have met with encouraging success, and their remarks regarding this year's competition are of interest:

"This year's competition covered a territory from Eyebrow on the north to Hearne on the south, and from six miles west of Caron to five miles east of Belle Plaine. Eighteen entries were received totalling almost seventy miles.

Allotment of Points

"Preliminary inspection was made on the first of June and a certain number of points up to a minimum of forty, depending upon the condition of the road at the beginning, were allowed each entry. In this way, the road which happened to be in a poor condition at the start was given a handicap over the road in good condition. An allowance up to ten points was also made in cases where the soil was difficult to work, and an extra five points per mile were given for every mile over three. The entries were all inspected every month during the summer by a representative from the Department of Highways, Regina, and points awarded according to the following schedule, twenty points being the maximum that any entry could earn during the summer under any one head:

Improvement of road in Crown	20 points
Improvement of road in Hardness	20 points
Improvement of road in Smoothness	20 points
Condition of ditches	20 points
Freedom from weeds	20 points
Amount of traffic	20 points
General appearance	20 points

Awarding of Prizes

"In each district a First prize of one hundred and fifty dollars ($150.00), a Second prize of one hundred dollars ($100.00), and a Third prize of seventy-five dollars ($75.00) is being paid, the prize money to be divided seventy-five per cent (75%) to the municipality in which the road is located, and twenty-five per cent (25%) to the operator who has the work in charge during the season.

"Considerable work has been done this season in the Moose Jaw district in addition to that entered in the competition, the Municipality of Moose Jaw, No. 161, having graded about eighty miles of road this summer."

Preliminary Analysis of Degree and Nature of Bacterial Removal in Filtration Plants

By Abel Wolman*

THE determination of a law of bacterial removal by rapid sand water filtration plants is of great practical importance and utility. Such determinations of plant efficiencies are valuable as indicators not only of present but also of future performance. It is quite evident that it would be desirable to measure quantitively the performance of a plant in such a way as to obtain a comparative conception of how well or how badly it is being operated. Since at present no agreement exists among operators, designers, or public health officials as to standard of "good performance," because, in the past, agreement has been prevented by the interminable search for a "standard effluent," itself the subject of disagreement, it becomes necessary to attack the problem of rating or standardizing plant accomplishment from another angle. In this discussion, an initial search is made for certain basic characteristics of rapid sand filtration. The term, rapid sand filtration, is here used more broadly than usually, to describe the entire process from preliminary coagulation through sedimentation or settling, filtration, and disinfection.

The measure of variable phenomena by comparison with ideal or normal conditions is a procedure common to scientific analysis. The application of this method offers here a fruitful means of testing our ideas of filtration efficiency. The first problem obviously consists in the attempt to determine a possible correlation between the number of bacteria in the final effluent of a filtration plant and the number in the raw water. A numerical statement of the problem should be clearer. If a plant uses a raw water containing 500 bacteria per cubic centimeter and produces an effluent containing 10 per cubic centimeter, will the same plant produce an effluent of 20 per cubic centimeter when the raw water content is 1000 per cubic centimeter? Can one predict, in other words, with any degree of precision, what effluent counts should be normally attainable with varying raw water counts ?

Standard from Normal Performance

The normal or ideal performance from which it is possible to obtain hypotheses as to standard empirical accomplishment is not difficult to deduce. The "normal empirical performance" may be defined as the accomplishment of a filtration plant which is known to be operating successfully. Successful operation can be said to exist wherever there is an unquestioned superior bacteriological and physical quality of effluent, consistent performance, excellent control, and scientific observation of operating details. Plants whose performance may be used as the basis for comparison and for the derivation of the law of bacterial removal are not at all rare. In this analysis, the operation statistics of the filtration plant at Avalon, Md., owned by the Baltimore County Water & Electric Co. and operated by S. T. Powell, were used.

This plant obtains its raw water from the Patapsco River, a highly polluted stream, ranging in turbidity during the year from 0 to 5000 parts per million, and in bacterial content (20°C. gelatine-48 hours), from several hundred to 150,000 per cubic centimeter. The watershed of the stream is composed largely of cultivated areas, with no large sewage polluting influences. This water is treated with aluminum sulphate, at an average rate of 0.8 grain per gallon, and is then allowed to settle for four hours. After leaving the sedimentation basin it is treated with calcium hypochlorite with an average dose of 0.34 part per million, and then passes through the rapid sand filters which have a capacity of 2,500,000 gal. per day.

The plant is controlled scientifically by a trained operator with the aid of modern equipment and laboratory observation. During several years of operation the bacterial content of the effluent has not exceeded, at any time, 20 bacteria per cubic centimeter. Presumptive tests for B. coli in lactose broth have indicated positive tests in 1 cc. less than 2 per cent. of the time during any year. The number and kinds of bacteria are determined in raw water and final effluent every day and general experimental data are constantly collected. It is clear, therefore, that the plant in Baltimore County approaches so closely, from the standpoint of operating results, the ideal plant as to justify the use of its performance as the basis of a law of filtration.

Determining Performance Curve.

In order to determine with some degree of accuracy the form of a characteristic empirical performance curve, the results of raw water and final effluent counts of the Avalon plant were plotted. In order to avoid plotting a mass of points which would tend to confuse, 7-day averages of both stations, rather than daily results extending over a period of nineteen months in 1915, 1916 and 1917, were used. In plotting these values, approximately 620 daily analyses were summarized. These were obtained in consecutive months and under every phase of operating conditions. No counts were discarded as being unfair or incorrect.

A study of the samples plotted reveals at once a consistency of arrangement. It is clear, too, that the performance of this normal plant is represented by the curves. Inasmuch as these curves are practically straight lines, within the limits shown, the derivation of their equation is simple. The equation of a straight line, when the results have ben plotted on a logarithmic basis, is given by: $c = \log y \div \log x$, where c is a constant for this particular plant, and y and x are respectively the raw water and final effluent counts.

It would appear, therefore, that the "normal empirical performance" is represented by a curve having the equation: $y = x^c$. A tentative hypothesis, with regard to bacterial removal by filtration action, may be promulgated, therefore, as follows: The final effluent count, under normal operating conditions, is an exponential function of the raw water count. This hypothesis provides a means of determining whether or not a plant under scrutiny is, at least, "performing normally," where normal performance would be interpreted as conformity to the logarithmic curve of filtration.

The "normal performance" curve demonstrates the fallacy of assuming that the **difficulty** of removal of bacteria is relatively the same regardless of the number of bacteria in the raw water. Although this assumption is rarely publicly proclaimed, it is usually summoned, however, to the aid of those plants which, for one reason or another, are so successful as to require a specious hypothesis, fairly reasonable to the layman, to support their claims to maximum efficiency of 99 per cent plus. The practical results of a scientifically controlled plant certainly seem to lead to the conclusion that increases in raw water bacterial content decrease the corresponding bacterial content **interval** in the final effluent.

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*Division Engineer, Maryland State Department of Health.

It should be added, too, that the equation of normal performance, $y = x^c$, offers a new quantitative measure of the efficiency of any plant, obtained by evaluating in any case the constant, c. Such a measure, among other qualities, has the advantage of a rational basis and of a practical significance.

Coefficient of Efficiency

What absolute value this constant, c, or the so-called "coefficient of efficiency," should attain is dependent upon individual opinion of "good performance." It is of interest to note, however, that, in a survey of 19 rapid sand filtration plants, varying in size from 2,200,000 gal. to 80,000,000 gal. filtered per day, the coefficient of efficiency of these plants has attained an annual average of over 2.5. The raw waters which these plants had to treat contained turbidities ranging from an annual average of 1 to 561 parts per million, and average bacterial contents from 350 to 16,500 per cubic centimeter. The 19 plants chosen, therefore, for the evaluation of c, are representative, in their initial conditions, of rapid sand filtration.

The probable existence of the law of filtration, $y = x^c$, combined with known values of c, practically attainable, gives the investigator of filtration plant accomplishment the fundamental criteria with which to measure both the character and the amount of removal in any particular plant. The objection may be raised to the above method of critical standardization of plants, that all do not function in a similar manner, on acount of differences in raw water, resulting from peculiarities of suspended matter, variations in resistance of bacteria, and other similar factors. This objection does not seem to the author to be entirely valid, since peculiar characteristics of raw water are usually provided for by variations in design, such as increased periods of sedimentation and greater doses of disinfectant. It is reasonable to suppose, therefore, that given plants, initially properly designed for local conditions, should function according to some common law since death rates under disinfection, devitalization and sedimentation and filtration of bacteria differ in the degree, but not in the kind, of changes effected.

The preliminary theory of bacterial removal by filtration is supported by the average monthly results from several large rapid sand plants in the United States. It is quite obvious that each plant follows in its performance the characteristic $y = x^c$ curve.

It has a tensile strength of 7,000 pounds per square inch, as compared with 10,000 to 19,000 for white oak and 8,000 to 10,000 pounds for maple. Its strength in compression with the grain is 4,000 to 5,700 pounds, while other woods in this class run a little higher.

Poplar has the lowest strength in both tension and compression of any of the so-called hard woods.

A Fighter's Opinion of Strikers

I know that a great many war workers have been, and still are, bearing cheerfully and willingly the long strain of war work, and I very gladly and thankfully offer my testimony to what I have seen of this good spirit. But it would be idle to deny, since the proofs have been too plain, that many war workers are not doing their best and utmost, are not playing the game as they might do and ought to do.

* * *

Surely by now every worker might appreciate the fact that whatever good cause they may have for "war weariness" they are at least infinitely better off than any man in the firing line; surely they can understand how bitter men here feel when they hear and read of all these manifestations of labor "discontent" and "unrest."

* * *

I beg each war worker to remember that every slackening of their efforts, every reduction of output, every day wasted, every stoppage of work, inevitably encourages the enemy, prolongs the war, keeps men chained to the misery of the trenches, piles up the casualties, continues the loss of life. A strike, or the threat of a strike, may win for the workers their 12½ per cent. increase of pay, the "recognition" of some of their officials, their improved comfort, but every such "victory" is only gained at the expense of the men in the trenches, is paid for in flesh and blood in the firing line.

* * *

It may be that one grows one-sided in ideas after more than three years' soldiering, but can you blame us if we feel contempt for pitiful grumblers and complainers who have a good roof overhead, a warm room and fire, a dry bed, and no real lack of food, if we feel anger against men who have all these things and yet go on strike, knowing that we must pay the penalty? And let me flatly deny the claim which some strikers and agitators still make that in these upheavals and checks on war industry they are "fighting for the rights of their mates in the trenches." Their "mates in the trenches" will be ready and able to, and certainly will, fight for their own rights when the war is won and they can do so without endangering or delaying the winning.

Meantime, can any man be fool enough honestly to believe that "mates in the trenches" want anything more urgently than to win the war and get out of it?

* * *

Will it soothe or satisfy a man to be told the strikes are really fights for his rights, especially when you remember he knows that as a result of the strike he may be too dead to have any rights to be fought for?—Major Ewart in Foreward to "Front Lines."

Canadian Highway Construction

By Mr. Harry Stewardson*

SO much has already been said and written on the subject of good roads that it is well nigh impossible for one to approach the subject from a new angle, and what I have to say will probably be merely a repetition of what has often been said before. However, we must all realize how vitally necessary it is for the welfare and development of this province that our existing highways should not be allowed to deteriorate, but should be kept in good condition, and also that a definite programme of improvement and extension should be adopted. To-day the most important consideration should be given to road classification. We should consider how to distribute the cost of construction and maintenance so that the necessary money can be secured and the necessary expense fairly placed upon the people who use the roads and the communities which receive the benefit and not continue to have an inequitable and unbearable burden placed upon the local community or upon the individual who makes little use of the road and who receives little benefit from it.

The first efforts of those interested in good roads should be concentrated on linking up the gaps between the permanently improved highways which now exist and these efforts should be closely followed by endeavoring to extend the improvements to other main highways connecting the important agricultural and industrial centres.

The question of the cost of construction of our streets and highways is a very serious one and is probably the greatest stumbling block in the attainment of good roads. When the first cost of improvement is assessed against the property abutting on the street or highway, the average property owner is naturally anxious for a road that costs but little, because he is the person who has to pay for it, and he does not seem to care or to realize that it may be entirely unsuitable, soon wear out and become an endless source of trouble and expense. I am afraid that these false ideas of economy will always stand in the way of the attainment of good roads while the present system of assessing a road improvement against the adjoining property remains in force. The local improvement tax, which is a tax levied by cities and municipalities against the adjoining property for the improvement of streets and highways, is a lien upon the property considered to be benefited by the improvement, and if the tax or assessment is not paid the property may be sold to pay such assessment. This taxation frequently becomes a heavy burden on the poor man, who is endeavoring to buy or to keep up a home of his own, and the menace of it deters many others from even trying to get a home.

Who Should Pay?

A further inequity in our present system is that, although a person owning property on an improved street has to pay a very large proportion of the cost of the improvement adjoining his own property, he is also assessed, through the current revenue tax, for a proportion of the cost of temporary roads and sidewalks in other parts of the city. The persons who derive the greatest benefit from the construction of good roads are not necessarily the persons whose property adjoins the road, but those people who use the road by travelling in wheeled vehicles from one place to another by way of the road. Does it not then seem logical that it is not the real property but the vehicle that should be assessed for both the construction and the upkeep of our streets and highways? I think that all owners of automobiles and other vehicles will admit that the amount of travelling which they do on the street on which they live is a very, very small proportion of the mileage over which their vehicle travels. If it is admitted that it is the vehicle which should be assessed, the question arises as to how the assessment could be made fair and equitable. The old toll gate method would, to my mind, be objectionable as tending to restrict traffic, nor would it be capable of practical application, as a large proportion of the revenue created would be used up in cost of operation and, in any event, it could only be adopted on trunk roads. This would not relieve the situation in so far as the purely local roads are concerned. The method of assessing on a wheel basis appeals to me as being the most equitable. As a writer on this subject humorously puts it: "We should pay through the wheel and not through the nose for our pavements." My ideas run along the line of a double tax, one collected by the provincial government, the revenue from which would be applied to the construction and maintenance of the purely local roads. The municipal tax could be collected from the owners of all vehicles having their headquarters within the municipality. All monies raised by this taxation would be used on the roads and not applied to any other works.

Ontario Province

In the province of Ontario, the government has adopted the policy of paying the whole of the cost of construction and maintenance of what it designates as "Provincial Highways." It also pays 40 per cent. on the construction of "suburban roads" and 20 per cent. of the cost of maintenance. This policy should enable the cities and municipalities to keep their roads in a reasonable state of repair without putting an excessive burden on the property owner.

The Nova Scotia Act

Last year the government of the province of Nova Scotia very wisely passed an act providing for the setting up of a Provincial Highways Board. It will be the duty of this board to collect information regarding the highways of the province, to lay out, plan, classify and control the construction and maintenance of the roads of the province. A provincial highways fund is to be established consisting of contributions from the federal and provincial governments, all license fees collected under the Motor Vehicles Act and a small stated percentage of property and income tax receipts. I do not think that the average person who owns a vehicle would object to a wheel tax that would ensure that he had good roads to travel over and which would result in a considerable saving in his operating expenses. The saving in repairs, gasoline, oils, etc., would surely more than compensate him for a small tax to be collected. I would like to hear this subject of road taxation thoroughly discussed, as the present system is one that is putting our cities and municipalities in a position where before long it will be impossible to give the citizens good roads with reasonable taxation.

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* City Engineer, New Westminster, before British Columbia Good Roads Association.

The purpose of road building is to provide a way for transporting goods and persons from one locality to another with the least amount of power and expense. The ease with which this traffic can be carried on is governed by the resistance which a road offers to traffic and an ideal road is one that will offer the maximum amount of resistance with the minimum amount of friction. Before the advent of high speed motor-driven vehicles a well constructed water-bound macadam road had these necessary qualifications, but nowadays, when the great preponderance of traffic is of a high speed motor-driven character, a water-bound macadam road is by no means ideal. A description of a water-bound macadam road may not be out of place for the benefit of those who are not familiar with the technical names of the various types of roadway.

Water-bound Macadam

A water-bound macadam road is constructed of broken stone, varying in size from three inches to fine screenings, carefully spread on a prepared sub-grade, compressed with a heavy roller, and sufficient water applied to cement the whole into a homogeneous mass.

During the years 1911, 1912 and 1913 the city of New Westminster constructed many miles of this type of roadway at an average cost of 90 cents per square yard. At this time Hassam and bitulithic each cost $2.25 per square yard. Owing to the increased cost of both labor and material, a macadam road now costs $1.10, and it is reasonable to assume that the cost of other types of paving has increased in an equal ratio of proportion.

It is a difficult problem for those interested in road building and one that has not yet been satisfactorily solved, to devise a road surface which will be satisfactory to both horse-drawn and motor-driven traffic. An ideal surface for automobiles will not provide a good foothold for horses, nor will a roughened surface prove entirely satisfactory for automobiles. These two types of traffic differ so absolutely in their requirements that this fact alone must tend very considerably to hasten the time when horse-drawn traffic will be entirely eliminated from our main highways.

Roads for Motor Traffic.

In view of the fact that motor vehicles are so rapidly superseding horse-drawn traffic, the efforts of road builders are being more particularly concentrated on securing a pavement, the first cost of which will not be prohibitive and upon which the maintenance, under motor traffic, will also be within reasonable bounds. In so far as the highways connecting New Westminster, Vancouver and the neighboring municipalities are concerned we are served with a number of well-constructed macadam and gravelled roads, and what we now need to keep these roads from rapidly wearing out is a surface or coating of some material of a lasting nature. In my opinion there is no more necessity to disturb our existing macadam and gravelled roads in order to construct a concrete base on which to place a wearing surface than there would be to excavate solid rock for a similar purpose. Our existing roads are now so thoroughly consolidated, where draining is good, that any load placed upon them is sufficiently well distributed for all reasonable demands. In the spring of 1917 the city of New Westminster applied to its leading macadam roads a coating of asphaltic oil, containing about 80 per cent. of asphaltum. This asphaltic oil was applied at a fairly high temperature and the coating averaged one-twenty-fifth part of an inch in thickness; sand was afterwards spread over the oil, forming a surface mat. This treatment has proved of great value in protecting the roads from the winter rains and snow and from the ravelling effect of fast-moving traffic, but it cannot be regarded as a permanent solution of the problem. The spray coat is necessarily so thin that the roads require annual, and on the heavily trafficked streets, semi-annual treatment to keep them in fair condition. The cost of this treatment only averaged two cents per square yard, or $210 per mile of roadway 18 feet wide. Since the time when it became evident that an ordinary macadam road would not stand up under motor traffic innumerable pavements have been patented and all of them have their advocates, but it is pretty generally conceded by highway engineers that the surface should be of a bituminous or tar composition. The principal advantages possessed by bituminous or tar surfaces are that they can be expeditiously laid, thereby causing the minimum amount of inconvenience to traffic; they are easily repaired without leaving an unsightly patch; they are far less noisy than concrete; there is neither vibration or concussion when travelling over them and, if properly laid, they do not crack. A method of treating existing macadam roads which has met with a great amount of success in the Eastern States and on the European Continent is that known as tar-macadamizing, the mode of procedure being as follows:

On a thoroughly consolidated water-bound macadam road which has been well broomed and swept free from dust, and after all depressions have been filled, a layer of crushed rock is spread, varying in thickness from three inches to one inch, according to the amount and character of traffic the roadway will be called upon to carry, and thoroughly rolled.

Into the new surface a mixture of tar and pitch is poured, either from hand pouring cans or by wheeled distributors, the mass is then rolled, chippings being broomed into the interstices during the rolling. After this second rolling the surface is broomed free from all loose stone and treated to a light, or squeege, coat of tar and pitch, covered with a layer of coarse sand and again rolled.

In the city of Liverpool, England, this type of surface was first laid in the year 1901, on a street carrying a weight of traffic amounting to 120,000 tons per yard width per year, and has been in continuous use ever since without requiring any expenditure for maintenance or repairs. The class of traffic carried by this road consists of automobile and carriage traffic, besides a considerable amount of a heavier character.

Satisfaction on Vancouver Island

Coming close to home, I am indebted to Mr. David Whiteside, M.L.A., for the information that a considerable mileage of this pavement was laid in the municipality of Oak Bay, Vancouver Island, during the years 1912, 1913, 1914, and 1915, and is giving excellent satisfaction. The surface was laid on a newly constructed water-bound macadam road, and the thickness adopted was two and one-half inches. The cost of the surfaces varied from 45 to 50 cents per square yard, or $4,752 to $5,280 per mile of roadway 18 feet wide. And the annual maintenance cost is slightly over two cents per square yard. Making due allowance for the large increase in the cost of both material and labor, the following figures should be very close for roads in this vicinity at the present time:

One-inch surface, $6,000 per mile, 18 feet wide.
Two-inch surface, $10,000 per mile, 18 feet wide.

These figures refer, of course, to the cost of surfacing only and do not include the cost of preparing the road to receive the surface. This expense will naturally vary with the condition of the road to be treated.

It may be argued that this "penetration" type of surfacing is not so good as the mixed method, such as the surface on a number of our city streets, and on the Vancouver-Eburne road, and this may be true, but from my own knowledge of the Liverpool streets, from Mr. Dean's experience of the Massachusetts highways and from the experience of many other municipal and highway engineers who have laid similar pavements.

Advantages of Penetration Type

It has two great advantages over the mixed method in as much as that it can be laid without any additional outlay for plant except a small expenditure for tar boilers and pouring cans and, best of all, there are no patent rights and, consequently, no royalties to pay.

The reason for dwelling at length on this particular type of surfacing is that, with the great extent of the province of British Columbia requiring an enormous mileage of roads for its proper development, the heavy cost of grading owing to its hilly formation and the very small mileage of roads we now posses in comparison with the area of the province, the cost of the more expensive types of pavement in any appreciable quantity would preclude the possiblity of our ideas materializing for very many years, and consequently retard our growth in all lines of industry.

So much literature is available extolling the virtues of concrete and the various types of patent bituminous pavements that it is entirely unnecessary to mention them here. The gentlemen representing the interests concerned will be very much in evidence with facts and figures when the psychological moment arrives.

With an inexpensive pavement such as the one described, a progressive policy of improvement and a more equitable method of assessment, it would not take many years to gridiron the lower mainland with a network of good roads without causing a drain on the provincial treasury or a hardship on the individual property owner.

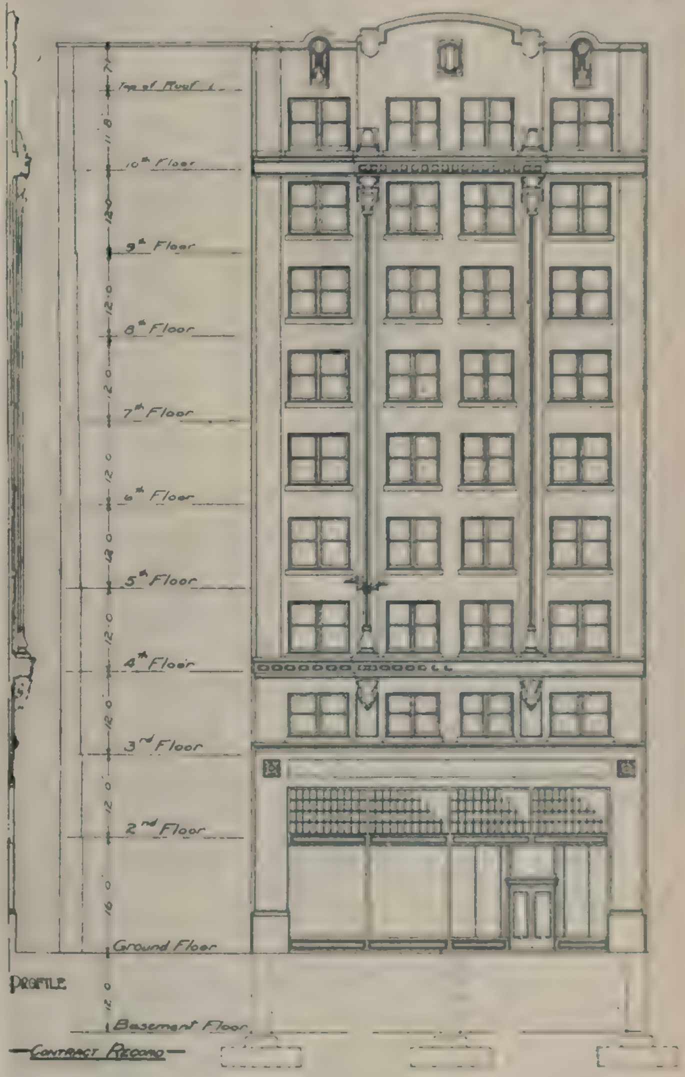
In conclusion I would say that no matter what price you pay for your pavement it will prove dear unless the work is carried out with the best materials, under the direction of competent, experienced men and an efficient system of maintenance adopted.

According to a recent press despatch, the first step has been taken towards re-organizing and re-building Belgium. Belgian engineers left England soon after the evacuation of Ostend, for the purpose of taking charge of surveys and constructive work in the harbor and town. After the engineers get their plans well under way, the services of builders and contractors will be requisitioned, and then manufacturers and business men will be sent out to lay again the foundation of the country's industries.

Another Ten-Storey Building for Montreal

ANOTHER ten-storey building is to be constructed in Montreal for Mr. J. E. Wilder, from plans drawn by Mr. C. R. Tetley, A.R.I.B.A., Montreal. The site is on Bleury Street, and covers an area of nearly 10,000 sq. feet.

The building will consist of a large basement, a store on the ground floor, and loft storeys above this. It is to be of reinforced concrete, built on the system of the Trussed Concrete Steel Co. of Canada, Limited. The elevation of Bleury Street, shown in the illustration, will be of brick and stone, the former being dark in color and the stone light, making a striking contrast and emphasizing the dark brick panels. The exterior will be entirely of stone up to the top of the third storey; the same material will be employed for the central portion of the exterior above the third floor, while brick with stone trimmings will be used for the outside sections of the facade. Above the store and also at the top of the building here will be contrasting panels, in brick and stone.



The store on the ground floor is laid out with the shipping room at the rear, and as the building runs through to Balmoral street, the entrances to the shipping room are on this street. The shipping room is divided from the store by a brick fire wall, having an entrance from the store by means of a door and wooden steps, the Balmoral Street end of the building being two feet higher than that of the Bleury Street portion. Two freight elevators are to be installed in the shipping room. A passenger elevator will be provided in the store section of this floor, serving all floors. The stairway will lead from the basement to the tenth floor, the elevator being placed near the stairway. The ceiling of the store is laid out with plaster beams and panels.

The floors will be of reinforced concrete, covered with matched birch flooring, the floor slab being carried on reinforced concrete beams and columns. The work is being done by day labor.

Canada's Shipbuilding Developments

HON. C. C. Ballantyne, Minister of Marine and Fisheries, announced recently that, under the government's shipbuilding programme, contracts had been placed with the various yards in Canada for building thirty-one steel ships, from 3,400 to 8,100 tons capacity. Some of the vessels will be the one-deck type and some of the two-deck, suitable for bulk and general cargo. They will be built to Lloyd's specifications, and their speed will vary from 9 to 12 knots. The first launching, under the programme, will take place from the yard of the Canadian Vickers, Limited, Montreal, towards the middle of November, when two vessels—one of 4,300 tons and another of 8,100 tons—will take the water. They will be named, respectively, "Canadian Voyageur" and "Canadian Pioneer." The keel of the first ship, of 4,300 tons, was laid on March 12th last, while that of the 8,100-ton vessel was laid on July 13. The Minister states that unless delays in the delivery of steel occur, seven or eight additional vessels will be ready for commission on the opening of navigation next spring, and it is expected the whole 31 ships, aggregating 175,000 tons, will be launched before the end of next year.

The delay in laying keels and completing ships is due to the fact that all the ways were occupied with the construction of ships for the Imperial Munitions Board. As rapidly as the ships being constructed for the board are completed, the berths are immediately occupied with the construction of ships under the Government programme.

Favorable Prices

"In January last and for some months previous to the Government's decision to engage in shipbuilding," said Mr. Ballantyne, "private firms for whom ships were being built in Canadian yards were paying prices for plates ranging from $100 to $180 per ton, and several small lots had to be purchased for upwards of $200 per ton. Through the courtesy of the United States Government, the department was enabled to obtain an assurance that sufficient plates to meet the requirements up to July or August next would be available from United States sources, at the rate fixed by the United States Government—namely, $65 per ton. It was in these circumstances and in pursuance of a policy to make Canada self-contained in the matter of shipbuilding that the arrangement was concluded with the Dominion Steel Corporation for the erection in Sydney of a plate mill and the purchase therefrom of 250,000 tons of ship material at a basic price of $83 per ton.

"The contract with the Steel Company provides that the price of plates will be reduced proportionate with any reduction that may hereafter occur in the cost of producing steel ingot. This cost will be determined at the end of every six months period by auditors selected by the Government for that purpose. While the fixed price seems high, it is from fifty to one hundred per cent.—and more in many cases—lower than the prices then obtainable in the open market. It was necessary to provide assured supplies of plates for Canadian shipyards and other Canadian industries.

"The world-wide demand for tonnage continues, and is likely to continue for a number of years. So much is this the case that if the Government at the present time decides to dispose by sale of the contracts already concluded, very substantial profits would accrue. The policy of the Government, however, remains what it was at the outset—to retain for the use and advantage of the people of Canada all vessels now under contract or to be hereafter contracted for."

Mr. Ballantyne also expressed the view that the rates of freight prevailing would continue for some time after the war, and said that it was the intention of the Government to operate its vessels in connection with the Canadian National Railway system. He further authorized the statement that on his recommendation the Government had decided that the Government vessels to be constructed under the Government programme will be operated by a steamship company organized to work in co-operation with the Canadian National Railway system free in all respects from interference of any kind, and under the management of D. B. Hanna and his officials. In the adoption of this policy the Government is following the system adopted and now in operation by the Canadian Pacific Railway.

The Dunlop Rubber Company were one of the first to announce a subscription to the Victory Loan. The directors decided, after a brief discussion, to subscribe for one million dollars worth of the bonds. This subscription did not represent conversion of previous loans, nor did it include personal subscriptions by either directors or employees of the company. This announcement was telegraphed to the leading newspapers all over the country and was the first large announcement to appear anywhere in Canada. The Dunlop factory and office staff also got their Honor Flag for obtaining the subscription percentages set by the Victory Loan committee. One of the most touching things in connection with the employees' campaign was that the first subscription came from Pte. W. C. Dies, formerly head of Dunlop Shipping Department, who is probably the worst wounded man returned to Canada. Private Dies lost both eyes and his right hand at Vimy Ridge and was awarded the Military Cross. When he heard that the employees' subscription list was open he phoned the company and asked to have his name put down for $200.00.

The plant of the Cement Products Co. of Canada, on the Island of Orleans, P.Q., has been sold by auction. The plant, in pre-war days, was operated by a German named Mundheim, and it was alleged that enormous concrete foundations were erected on the island for the purpose of accommodating German guns which would command the St. Lawrence channel. Mundheim was eventually detained as an alien enemy, and the plant ceased operations. A considerable amount of the machinery was German built. The property, valued at $75,000 by the liquidators, sold for $8,450. G. Lachance, Regd., of Quebec, the purchasers of the buildings, land and beach lots, propose to continue operations. The Dominion Iron and Wrecking Co., Montreal, bought some of the machinery.

Better System of Highway Cost Keeping

By James J. Tobin and A. R. Losh* (Continued)

Detail of Cost Accounts and Necessary Codes

THE detail in which costs are recorded must be left to the judgment of the supervisor or engineer in charge of the work. Unnecessary refinements are not desirable, as they only increase the work of those who used the data. On the other hand, divisions that are too general and inclusive will prevent the study of results for the purpose of promoting efficiency. The use or final disposition of the data is the factor which should determine the necessary details.

For example, let it be assumed that a county engineer or superintendent desires costs on a brick road for the purpose of making reports on expenditures to the board of highway supervisors. In this case summary costs of completed parts probably would meet the requirements. The divisions would logically be the main divisions of the road and the costs would be collected by these divisions. This would provide the simplest division and consequently the simplest code, which for the case assumed would be as follows:

Cost Divisions

	Code
Right of way	09
Grade and roadside (or grading)	19
Roadway (or surfacing)	29
Ditches and drains	39
Bridges and culverts	49
Supplementary parts	59
Engineering and supervision	69
Administration	99

The first and the last two of these divisions would be compiled from office data so that the cost keeper would be concerned with only five divisions of field data.

The next advanced step that would be desirable in many cases would be the cost of major operations divided by road parts. This would give information suitable for the comparison of results with work of a like character or with unit prices or estimates.

Cost Divisions

Road part	Operation	Code
Right of way:		
Plans and Surveys	General	01-26
Real Estate		02-
Miscellaneous		09-
Grade and roadside:		
Miscellaneous	Clearing and grubbing.	19-08
Miscellaneous	Excavation, common	19-17
Roadway:		
Subgrade	Shaping	20-59
Base course	Laying	23-34
Top course	Laying	27-34
Ditches and drains:		
Paved gutter	Excavating, common	31-17
Paved gutter	Laying	31-34
Tile drains	Laying	33-34
Catch basins	General	33-26
Bridges and culverts:		
Foundations	Excavating, common	40-17
Foundations	Piling driving	40-45
Foundations	General	40-26
Abutments	General	41-26
Superstructures	General	43-26
Miscellaneous		49-
Supplementary parts:		
Signs and sign posts	General	50-26
Guard rails	General	52-26
Curbs	General	53-26
Miscellaneous		59-
Engineering and supervision:		
Supervisory engineering	General	67-26
Inspection	General	68-26
Miscellaneous		69-
Administration:		
Engineering, departmental		97-
Miscellaneous		99-

For the purpose of obtaining costs in more detail than is given in the foregoing, both the class and operation codes are susceptible of further divisions. In the following, divisions are made of the example chosen which are as complete as will generally be practical to use for highway cost keeping except in those cases where efficiency studies are desired.

Cost Divisions

Road part.	Operation	Code
Right of way:		
Preliminaries		00-
Right-of-way surveys	General	01-26
Right-of-way plans	General	02-26
Real estate		03-
Damages		04-
Miscellaneous		09-
Grade and roadside:		
Cuts and embankments	Excavating, common	10-17
Cuts and embankments	Excavating, borrow	10-16
Cuts and embankments	Drilling	10-14
Cuts and embankments	Blasting	10-03
Cuts and embankments	Loading	10-35
Cuts and embankments	Hauling	10-31
Cuts and embankments	Wasting materials	10-69
Cuts and embankments	Rolling	10-56
Shoulders.	Rolling	11-56
Shoulders.	Shaping	11-59
Berms and slopes	Trimming	12-66
Berms and slopes	Planting	12-48
Miscellaneous	Clearing	19-07
Miscellaneous	Grubbing	19-28
Miscellaneous	Blasting	19-03
Roadway:		
Subgrade	Shaping	20-59
Subgrade	Sprinkling.	20-63
Subgrade	Rolling.	20-56
Base course	Loading and hauling	22-36
Base course	Forming	22-25
Base course	Mixing	22-38
Base course	Placing	22-46
Base course	Shaping	22-59
Cushion course	General	26-26
Top course	Loading and hauling	27-36
Top course	Laying (brick)	27-34
Top course	Rolling (brick)	27-56
Top course	Grouting	27-27
Top course	Curing concrete.	27-11
Miscellaneous	Cleaning	29-06
Ditches and drains:		
Ditches and gutters.	Excavating, common	30-17
Ditches and gutters paved	Forming	31-25
Ditches and gutters paved	Loading and hauling	31-36
Ditches and gutters paved	Mixing and placing	31-39
Ditches and gutters paved	Finishing	31-24
Ditches and gutters paved	Curing concrete.	31-11
Tile drains	Excavating, common	33-17
Tile drains	Laying	33-34
Tile drains	Loading and hauling	33-36
Tile drains	Tamping	33-65
Tile drains	Back filling	33-01
Catch basins	Excavating, common	34-17
Catch basins	Loading and hauling	34-36
Catch basins	Laying (brick)	34-34

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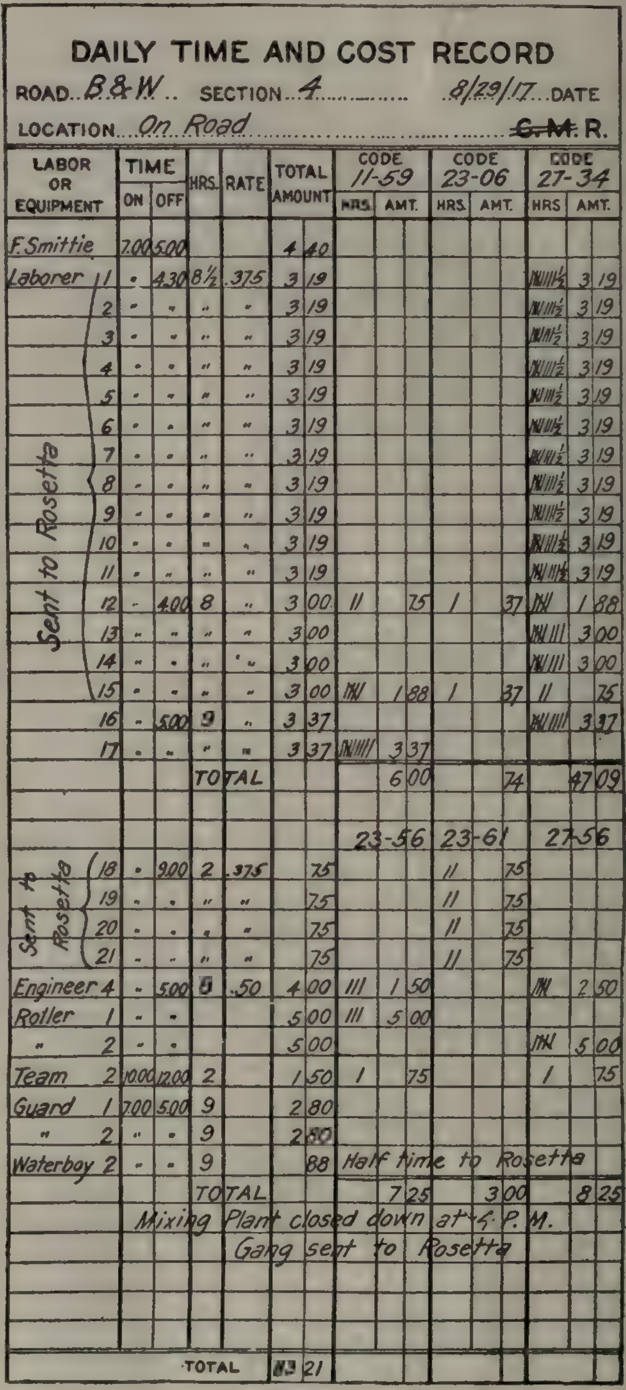
*From Bulletin issued by U.S. Dept. of Agriculture.

Bridges and culverts:		
Foundations	Cofferdaming	40-09
Foundations	Cribbing	40-10
Foundations	Excavating, common	40-17
Foundations	Excavating, wet	40-21
Foundations	Forming	40-25
Foundations	Loading and hauling	40-
Foundations	Pumping	40-51
Foundations	Pile driving	40-45
Foundations	Mixing and placing (concrete)	40-39
Foundations	Back filling	41-01
Abutments	Loading and hauling	41-36
Abutments	Laying (masonry)	41-34
Abutments	Pumping	41-51
Abutments	Quarrying (masonry)	41-52
Piers and bents	(Same operations as abutments)	42-
Superstructures	Blacksmithing	43-02
Superstructures	Building false work	43-05
Superstructures	Curing concrete	43-11
Superstructures	Finishing	43-24
Superstructures	Forming	43-25
Superstructures	Loading and hauling	43-36
Superstructures	Mixing and placing (concrete)	43-39
Superstructures	Placing steel	43-47
Box culverts	Excavating, common	44-17
Box culverts	Loading and hauling	44-36
Box culverts	Forming	44-25
Box culverts	Mixing and placing	44-39
Box culverts	Curing concrete	44-11
Pipe culverts	Back filling	45-01
Pipe culverts	Excavating, common	45-17
Pipe culverts	Forming (headwalls)	45-25
Pipe culverts	Laying (pipe)	45-34
Pipe culverts	Loading and hauling	45-36
Pipe culverts	Mixing and placing	45-39
Miscellaneous	Cleaning	49-06
Supplementary parts:		
Signs and signposts	Building	50-04
Signs and signposts	Loading and hauling	50-36
Signs and signposts	Painting	50-43
Monuments	General	51-26
Guardrails	Building	52-04
Guardrails	Loading and hauling	52-36
Guardrails	Painting	52-43
Curbs	Back filling	53-01
Curbs	Curing concrete	53-11
Curbs	Excavating, common	53-17
Curbs	Finishing	53-24
Curbs	Forming	53-25
Curbs	Mixing and placing	53-39
Riprap and revetments	Loading and hauling	55-46
Riprap and revetments	Placing materials	55-46
Roadside treatment	Clearing	56-07
Roadside treatment	Loading and hauling	56-36
Roadside treatment	Planting	56-48
Roadside treatment	Painting	56-43
Engineering and supervision:		
Location and relocation surveys	General	60-26
Surveys for operations	General	61-26
Plans	General	62-26
Specifications and contracts	General	63-26
Estimates	General	64-26
Expense of awards	General	65-26
Office expenses engineering	General	66-26
Supervisory engineering	General	67-26
Inspection	General	68-26
Miscellaneous		69-
Plant and equipment:		
Quarries, pits, etc.	General	71-26
Camp buildings and shelters	General	76-26
Storage and transportation	General	77-26
Miscellaneous	Assembling	79-00
Miscellaneous		79-
Administration:		
Engineering		97-
Miscellaneous		99-

Recording Forms

Standard forms, to record the daily expenditure of labor, materials, and plant service, should be prepared for the use of the time-keepers or foremen responsible for reports. The use of nondescript forms or blank books should not be permitted, as such practice will result in unreliable data, often estimated at the end of the day's work, or a jumble of meaningless figures. Forms to be used for recording field data should be reduced, if possible, to pocket size for the sake of convenience. Two such forms are suggested herewith, the sheets being 4¾ inches wide by 10½ inches long.



DAILY TIME AND COST RECORD

ROAD B&W SECTION 4 8/29/17 DATE

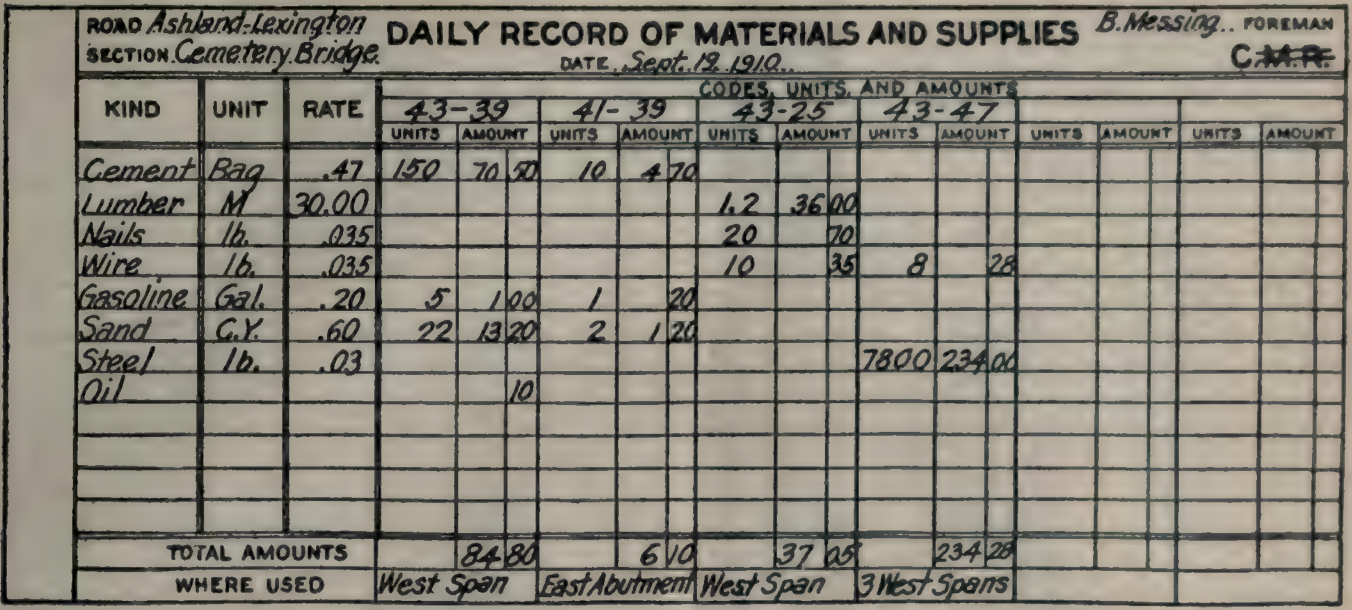
LOCATION On Road ~~C. M.~~ R.

LABOR OR EQUIPMENT	TIME ON	TIME OFF	HRS.	RATE	TOTAL AMOUNT	CODE 11-59 HRS.	CODE 11-59 AMT.	CODE 23-06 HRS.	CODE 23-06 AMT.	CODE 27-34 HRS	CODE 27-34 AMT.
F. Smittie	7.00	5.00			4 40						
Laborer 1	•	4.30	8½	.375	3 19					𝍸|||½	3 19
Sent to Rosetta 2	•	•	″	•	3 19					𝍸|||½	3 19
3	•	•	″	″	3 19					𝍸|||½	3 19
4	•	•	″	″	3 19					𝍸|||½	3 19
5	•	•	″	″	3 19					𝍸|||½	3 19
6	•	•	″	″	3 19					𝍸|||½	3 19
7	•	•	″	″	3 19					𝍸|||½	3 19
8	•	•	″	″	3 19					𝍸|||½	3 19
9	•	•	•	″	3 19					𝍸|||½	3 19
10	•	•	″	″	3 19					𝍸|||½	3 19
11	•	″	″	″	3 19					𝍸|||½	3 19
12	-	4.00	8	″	3 00	||	75	/	37	𝍸	1 88
13	″	″	″	″	3 00					𝍸|||	3 00
14	″	•	″	″	3 00					𝍸|||	3 00
15	•	•	″	″	3 00	𝍸	1 88	/	37	||	75
16	-	5.00	9	″	3 37					𝍸||||	3 37
17	•	″	″	″	3 37	𝍸||||	3 37				
			TOTAL				6 00		74		47 09
						23-56		23-61		27-56	
Sent to Rosetta 18	•	9.00	2	.375	75			||	75		
19	″	•	″	″	75			||	75		
20	″	•	•	″	75			||	75		
21	″	″	″	″	75			||	75		
Engineer 4	″	5.00	8	.50	4 00	///	1 50			𝍸	2 50
Roller 1	″	•			5 00	///	5 00				
″ 2	″	•			5 00					𝍸	5 00
Team 2	10.00	12.00	2		1 50	/	75			/	75
Guard 1	7.00	5.00	9		2 80						
″ 2	″	•	9		2 80						
Waterboy 2	″	•	9		88	Half time to Rosetta					
			TOTAL				7 25		3 00		8 25
	Mixing Plant closed down at 4 P. M.										
			Gang sent to Rosetta								
TOTAL					83 21						

Fig. 1

It is not expected that these forms will meet all the requirements for every system, but it is believed that they are correct in principle, and with slight modifications will be found applicable for any organization doing highway work.

The forms designed and suggested herein are based upon and developed from the great number of various forms now in use in highway work throughout the United States and Canada. The same form



ROAD *Ashland-Lexington* **DAILY RECORD OF MATERIALS AND SUPPLIES** *B. Messing* FOREMAN
SECTION *Cemetery Bridge* DATE *Sept. 19 1910* C~~M.R.~~

KIND	UNIT	RATE	CODES, UNITS, AND AMOUNTS 43-39 UNITS	AMOUNT	41-39 UNITS	AMOUNT	43-25 UNITS	AMOUNT	43-47 UNITS	AMOUNT	UNITS	AMOUNT	UNITS	AMOUNT
Cement	Bag	.47	150	70 50	10	4 70								
Lumber	M	30.00					1.2	36 00						
Nails	lb.	.035					20	70						
Wire	lb.	.035					10	35	8	28				
Gasoline	Gal.	.20	5	1 00	1	20								
Sand	C.Y.	.60	22	13 20	2	1 20								
Steel	lb.	.03							7800	234 00				
Oil				10										
TOTAL AMOUNTS				84 80		6 10		37 05		234 28				
WHERE USED			West Span		East Abutment		West Span		3 West Spans					

Fig. 2

is used for labor and equipment operations, but an additional form is necessary for materials, as it would be awkward to make out individual sheets for each kind of material. The daily summary of costs, and the periodic and total summary cost sheets are included, to show the final disposition and use of the data collected on the daily record forms. The final summaries also will fulfill the purpose of a final record of the cost of any job, and can be published for the purpose of substantiating and justifying the amounts expended.

Additional forms are necessary to record progress and character of the work by the supervising engineer, and the methods and amounts of payments made upon the work. Such forms will be treated in a subsequent bulletin.

The cost-recording forms are outlined and used as follows:

The form shown in Fig. 1 provides for 40 entries of men or equipment or both and their use on six classifications. The amount for each individual item can be given both in money and in total hours. This form shows that on August 29, 1917, foreman F. Smittie employed a gang of laborers numbered from 1 to 21; engineer, No. 4; rollers, No. 1 and No. 2; team, No. 2; guards Nos. 1 and 2; and waterboy, No. 2, on reconstruction work on the B. and W. Road, section 4. These codes show they were employed as follows:

11-59 Grade and roadside, shoulders, shaping.
23-06 Roadway, base course, cleaning.
23-56 Roadway, base course, rolling.
23-61 Roadway, base course, spreading.
27-34 Roadway, top course, laying.
27-56 Roadway, top course, rolling.

Notes on the sheet show that four laborers were transferred to foreman Rosetta at 9 a.m. and a large part of the crew between 4 and 4.30 p.m.

Material and Supplies

The form for materials and supplies (Fig. 2) is the same size as that for labor and equipment and may be carried by the timekeeper or foreman in the same book or binder with the other form. The material form is for one day only and 12 different materials may be recorded on a single sheet. The sheet shows distribution as follows:

For Operation 43-39, Mixing and Placing Superstructure

150 bags cement, at $0.47	$70.50
5 gallons gasoline, at $0.20	1.00
22 cubic yards sand, at $0.60	13.20
Oil	.10
Total for operation (used on west span)	84.80

For Operation 41-39, Mixing and Placing Abutment

10 bags cement, at $0.47	$4.70
1 gallon gasoline, at $0.20	.20
2 cubic yards sand, at $0.60	1.20
Total for operation (used on east abutment)	6.10

For Operations 43-25, Forming Superstructure

1,200 feet b.m. lumber, at $0.03	$36.00
20 pounds nails, at $0.035	.70
10 pounds wire, at $0.035	.35
Total for operation (used on west span)	37.05

For Operation 43-47, Superstructure, Placing Steel

8 pounds wire, at $0.035	$0.28
7,800 pounds steel, at $0.03	234.00
Total for operation (used on 3 west spans)	234.28

Daily Report of Costs

When the records of the amount of labor, the service of equipment, and the expenditures of materials have been completed the data for arriving at unit costs

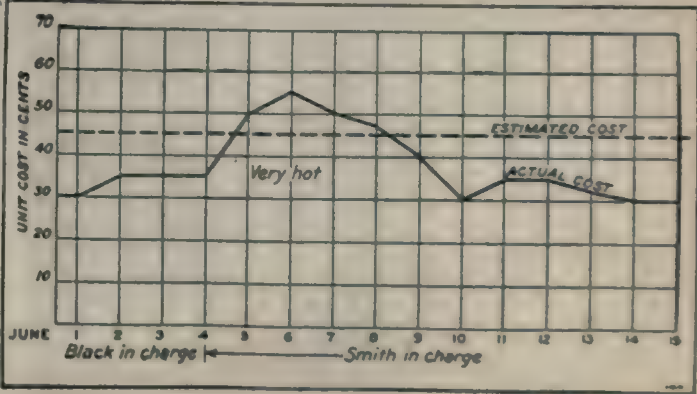


Fig. 3

are at hand. For convenience in bringing together these three elements of cost, a form has been drawn up called the "Daily report of costs." This is not for field use and is 8½ inches wide and 13½ inches long. The unit costs are arrived at by setting down against the code number all labor, equipment and material charges in detail. These are added together and the sum is divided by the units of work completed as estimated by the foreman. The units completed are checked against the engineer's monthly estimate and should not show a very great discrepancy, say not over five per cent. at the outside.

Immediate Use of Cost Data

When the daily reports of costs reach the official responsible for the work he can readily prepare a graph (Fig. 3) showing both the estimated unit cost and the actual daily unit cost in convenient form. Any wide divergence between the estimated and actual costs is apparent at once and can be investigated. The horizontal axis of the graph in this case is divided to show the days of the month. The vertical axis is divided to show the unit cost of the work. Some such chart will show effect of conditions upon the work.

Final Disposition of Cost Data

It has been pointed out that the objects of a cost-keeping system are two. First. to show the efficiency of performance and facilitate the reduction of costs, and, second, to supply data which may be used for the intelligent estimating of future improvements and to furnish materials for published reports.

Highway work obviously is a public improvement paid for entirely from funds derived from the public revenue. Ultimately, then, the taxpayer pays for all of this improvement and is entitled to a full and detailed account of how this money was expended. Again, public records of this kind are all that remain to be used for the comparing of the efficiency of one administration with that of another. It would appear, therefore, to be a step in the direction of good judgment for all those in charge of public improvements to adopt some simple system of cost keeping such as is outlined herein, which could be used both as an aid to present efficiency and as a complete report of the ability of the officials in charge to get the most for the public funds.

For the purpose of presenting in concrete form the costs and also to show the progress being made during the period of construction a form, "Report of Progress and Cost," is suggested. The costs which comprise this report may be compiled from daily reports. Such compilation may be made from day to day on a special form.

A "Final Cost Summary" sheet serves the purpose of bringing together all expenditures involved and all units of work done, and to show unit costs, total cost of parts, per cent. of cost by parts, and total cost of the entire improvement.

Coagulants versus Sand Filters as Aid to Water Purification in the Field

By Capt H. S. Briggs, R.S., and Capt. E. R. Marle, R.A.M.C.*

THE following is a description of an installation embodying the alum process which has now been at work for some months. The waterworks is situated in Flanders on a river highly charged with organic matter, and also, especially after rain, with very finely divided clayey material partly of a colloidal nature.

The works originally comprised a large settling tank, gravel pre-filters, sand filters of the ordinary pattern, and a clear water reservoir. As soon as construction was completed, it was evident the amount of water demanded would be largely in excess of that allowed for by the original design. It was also found that owing to the large amount of suspended matter in the water the sand beds speedily became choked, if the water was pased through at any other than a very slow rate. The length of time required for the sand filters to become "ripe" was also a drawback. It was therefore decided to clear the water as much as possible before delivery to the sand beds by precipitating the suspended matter with alum.

The process involves the addition of a solution of alum (Commercial Alumino-Ferric) to the water to be treated. Provided that the alkalinity of the water be sufficient, the addition of alum produces a white gelatinous precipitate of aluminium hydroxide, and this, mechanically, and by absorption, carries down with it not only the fine suspended matter, but also the colloidal matter, organic and inorganic.

Experiments of both a large and small scale having proved the efficacy of the process, four alum sedimentation tanks, each of some 40,000-gal. capacity, were constructed. These tanks were made by lining an excavation in the ground with tarpaulins, and were found perfectly satisfactory. Arrangements were made whereby the crude water could be discharged as required, into either of the four sedimentation tanks. The crude water discharge was led into a sloping wooden trough fixed at one side of each tank; into this trough was taken a feed pipe conveying the alum solution, the flow of which could be regulated by means of a stopcock.

A connection from the clean water main from the main pumphouse gave a supply of pressure water which was used for making up the alum solution in the raised tank and also for flushing through the alum feed pipes when necessary. A hose connection for washing out the sedimentation tanks was also provided.

The outlets from the sedimentation tanks were fixed a few inches above the bottom of the tanks and floating intakes have since been added. The alum treated water discharges were led to the original gravel prefilters, with connections to the clear water reservoir so that the gravel and sand filters could be cut out of the system if required. The bottom of each of the sedimentation tanks had a fall from the outlet end to a sump at the other end. When cleaning out was necessary the sludge was swilled down with a little water to the sump, and thence pumped out with a Merryweather to a drain.

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*From the Royal Engineers' Journal.

The amount of alum used varied from 7½ to 15 or even 20 grains per gallon. This large proportion, as compared with that used in civil practice, was rendered necessary both from the excessively foul character of the crude water and also from the necessity of reducing as much as possible the time of sedimentation. The amount of alum required varied from time to time according to the turbidity of the water and atmospheric conditions. No precise rule could be found, and frequent experiment was therefore necessary.

The rule was stated some years ago that the quantity of alum to be used should be one-half the chemical equivalent of the alkalinity of the water (expressed as $CaCO_3$). This, with most Flanders waters, is in the neighborhood of 20 grains per gallon. In many cases, however, smaller quantities have been found quite satisfactory. The alkalinity of the water is an important factor in the process, and in cases where the alkalinity is below about 15 parts of $CaCO_3$ per 100,000 it is necessary to increase the alkalinity by adding a solution of lime to the crude water at the same time as the alum solution.

The sedimentation process in the installation described above was eminently satisfactory. The suspended matter was deposited in from eight to twelve hours, leaving a perfectly clear supernatant water. The alum sedimentation was found to reduce the chlorine absorption in the subsequent chlorinating process, and the B. Coli content of the water was also to some extent reduced.

Water passed through the sand filters prior to the introduction of the alum process, although free from suspended matter, had a decidedly brownish appearance (the crude water was rich brown in color) and an objectionable musty or earthy taste. These characteristics appear to be due to organic substances of the nature of the "Albuminoid Ammonias." If such a water be chlorinated according to the requirements of the "Horrocks" test, although it may be safe, it is very unpalatable, and tastes strongly of chlorine. This taste persists even if there be absolutely no free chlorine present, and a great deal of trouble has been experienced from this cause in the case of water filtered through sand. It is believed that the objectionable taste is due to the products of the reaction between the organic substances in the water and the chlorine—to chloramines.

The water passing from the sedimentation tanks possessed none of the objectionable characteristics just described. It was clear, colorless, and its taste was good. Further, it could be efficiently chlorinated without a residual taste of chlorine remaining.

The alum-treated water, in the plant under consideration, was as a general rule passed through the sand beds to remove any solid matter that might have come from the alum tanks, but this procedure was for all practical purposes unnecessary, and in effect has frequently been dispensed with.

The alum tanks described have been working well for some months past, with an output which has on occasions reached 300,000 gal per day.

The precautions necessary for the successful working of the alum process may be summarized as follows:

(1) The proper quantity of alum must be added in the form of a solution.

(2) A very thorough admixture of the alum solution with the water must be ensured. This admixture must be continuous and uniform during the filling of the sedimentation tank.

(3) The mixture of crude water and alum solution must be kept in motion during the filling of the tank. This can be done by causing the mixed water to enter and flow along one side of the tank with a certain degree of momentum.

(4) A warning must be given against confusion between the terms "alumino ferric" and "iron alum." Although the latter substance has a certain action as a coagulant, it is totally unfitted for the purpose. On one occasion a consignment of "iron alum" was in error supplied to the waterworks described, and "alumino ferric" not being available, had to be used, but with disastrous results. Alumino ferric is the trade name of the substance which should be employed.

It must not be supposed from what has been said that precipitation of the suspended matter by alum is, in itself, sufficient for the production of a potable water. Whereas with the sand filter beds of civil waterworks practice, the removal of suspended matter and elimination of bacteria are effected at the same time, the alum process can only and should only be relied on to produce a clear water from a muddy source—although in the process the B. Coli content is appreciably reduced.

Further treatment is necessary to deal with the bacteria.

The best agent for the purpose is chlorine, introduced either as a gas or in the form of a solution of calcium hypochlorite (bleaching powder).

Chlorine gas an an oxydizing agent appears to offer the following advantages over a solution of bleaching powder:

(a) A more delicate adjustment of quantities can be made.

(b) It is possible to add a larger excess of available chlorine without the taste becoming pronounced.

(c) Successive samples of bleaching powder are found to vary in their available chlorine content, whereas in the gas process pure chlorine and nothing else is introduced.

(d) The labor of making up the bleaching powder, solution is avoided.

(e) Cylinders of liquid chlorine are more conveniently handled than corresponding quantities of bleaching powder and are less liable to deterioration.

The main difficulty in introducing the chlorine into the water is one of accurately measuring the dose. There are several varieties of apparatus constructed for the purpose, but even the best require an expert operator, are difficult to repair, and are extremely expensive. The system by which a bleaching powder solution is introduced into the water to be chlorinated will probably meet all requirements in the field. In whatever way the chlorine is added, the admixture must be uniform and the chlorine should be in contact with the water for at least 30 minutes before test samples are taken. The longer the chlorine is in contact with the water before the latter is pumped into the mains the better, since there is thus less chance of an excess of chlorine remaining to impart an objectionable taste to the water and the very small quantities of chlorine admissible only effect sterilization when the contact period is relatively long.

The following are, in the writer's opinion, the advantages of the alum process over sand filtration plants, whether these be of the mechanical filter type, the large open sand bed type of civil practice, or the smaller quick filter of coarse sand such as have been installed in some instances:

1. Economy of Labor in Construction.—Alum sedimentation tanks are easily made of excavations in the ground lined with tarpaulins. The bulk of this work is unskilled. Sand filters of the usual type must be made of brick or concrete and require an enormous amount of work in proportion to the results attained. Mechanical filters require special machinery and plant and a good deal of skilled labor in erection. Heavy and substantial foundations must be provided. Quick filters of coarse sand cannot deal efficiently with a really dirty water.

2. Economy of Labor in Maintenance.—All filters require a large amount of labor to be expended from time to time in cleaning the sand beds and washing and renewing the sand, compared with the labor in removing sludge from the alum tanks.

3. Economy in Wash Water.—Alum sedimentation tanks require in proportion much less water for cleaning out than is required for washing the sand of sand filter beds, and dirty water can be used for the purpose if desired.

4. Character of the Water Produced.—As already stated, certain waters retain objectionable qualities even after passing through sand beds. Alum treatment will remove such characteristics.

Good Roads in Pennsylvania

The electors of the State of Pennsylvania voted recently on a fifty million bond issue to be used solely for good roads. The State Highway Commissioner, Mr. J. D. O'Neill, in a written statement urging the support of the issue, makes the following points:

"I earnestly hope that the voters will favor the amendment, and authorize the Legislature to issue fifty million dollars in bonds for good roads. There is no valid reason why anyone should vote against good roads. If the bond issue is approved, it will not increase the taxes of any property owner, as the money to pay the bonds will be provided from taxes on corporations, and will be collected over a long period of years.

"Our state senator has made a positive declaration that he will see that the money is not spent until after the war is won and conditions have become normal, so that a good type of road can be secured at a fair price.

"My experience in building roads, extending over a period of seven years, has convinced me that good roads are a moral as well as an economic necessity. How can a farmer, or any other citizen, be expected to retain his religion if he has to wallow in a mud road several months each year? **How can we expect the boys and girls to remain on the farm and grow the foodstuffs necessary to feed the people in the cities if we do not provide them with good roads,** to go to and from market, and to enable them to enjoy some of the social activities of the towns? One of the grave questions of the day is the tendency of the people to flock to the cities and the only way we can check and overcome this is to give the people in the suburban sections good roads.

"My experience in Allegheny County, as well as throughout the State, has been that when an improved road is constructed, farms adjacent to the road increase from ten to fifty per cent. in value.

St. Marks School, Montreal, P.Q.

ST. MARKS School, Frontenac St., Montreal, has been constructed by U. Boileau, Ltd., from plans by Vautrin and Bernier, architects, Montreal. It was built for the Roman Catholic School Commissioners, and is for boys and girls. The total area of the site is 225 x 251 feet, the building occupying an area of 62 x 116 ft.; the greater part of the balance is for a playground at the rear of the school

Like many other schools recently constructed in Montreal, the building is divided into two sections, one for boys and the other for girls, being separated by a terra cotta and plaster wall, and both practically identical in accommodation.

The building, of three storeys and basement, is of concrete, on the Truscon system of the Trussed Concrete Steel Co. of Canada, Ltd. The exterior is of rustic brick with Montreal limestone trimmings, stone also being exclusively used in the exterior from the ground level to the top of the basement. The two main entrances on Frontenac Street, are of stone, with columns on either side, the steps being of the same material. At either end of the school are panels of brick. The cornice is of brick and stone, with a series of brick panels running almost the entire length of the building, and surmounted by a cross. The windows at the rear have stone trimmings, while the end walls have brick panels.

The interior partitions are of terra cotta and plaster, and the floors of hardwood, except in the lavatories, where they are of tile.

The basement contains the heating and ventilating equipment—the former being on the Dunham system —coal storage, etc.

The ground floor is mainly occupied by two large recreation rooms; here is also the principal's room, and a private room and a waiting room. The toilets are in the rear. The recreation rooms are reached by separate entrances from the playground, and also from corridors from the main entrances. The stairways leading to the storeys above are situated in these corridors, near the rear entrances, which total five on this side of the building, two into the school, two to the recreation rooms, and one to the basement.

The two next floors each contain five class rooms, eight being 24 x 29 ft each, and two 32 x 24 ft. each. Every class room has a coat-room adjoining. On the first floor three class rooms are for girls and two for boys, and on the next floor the order is reversed. The toilets are on the first floor, together with a store for books. This space, on the next floor, is occupied by two teachers' rooms, and with a small library. Each floor has a corridor running down the centre, and allowing communication between the boys' and girls' sections by means of fireproof doors built into the dividing wall.

An ornamental iron fire escape is provided for each section, these being placed on the exterior of the rear wall.

The interior staircases are of iron and slate. The roof is according to Barrett specification.

To find the area of the surface of a column, multiply the diameter by 3 1/7 and then multiply by the height. For instance, if your column is 21 inches in diameter, multiplying by 3 1/7 you get 66 inches, 5½ feet. Multiplying this by 10 feet, the height of the column, you get 55 square feet as the suface area.

Immediate Preparedness to Meet Post Bellum Economic Conditions

The following open letter has been sent to the Government by the Canadian Committee on Franco-Canadian trade expansion:—

To The Right Honourable Sir R. L. Borden, Prime Minister of Canada, and the Honourable Ministers of the Crown:

Honourable Gentlemen:—Deeply moved by Canada's effective co-operation, France seems anxious to show her appreciation of our efforts. Inspired by that desire the Comite France-Amerique which is presided over by Monsieur Gabriel Hanotaux, and whose principal object is to extend to the fields of industry the close relations now welding Canada and France on the fields of battle, calls our attention to the inception of the reconstruction works of the war devastated areas of France. It signals out that many nations are already on the ground ready and eager to seize upon this great trade opportunity and strongly urges Canada forthwith to do likewise.

More than two years ago, Sir George E. Foster preached the crusade of immediate preparedness to meet "post belum" economic conditions. Since then, men of authority have advocated the same gospel, laying stress on the enormous increase of our national debt and the grave danger of facing still heavier taxation with our munition factories closed, our industry and trade dislocated, our soldiers and munition workers clamoring for work. This and worse have been admitted as possible if we do not immediately foresee and provide.

In his last annual report the Minister of Trade and Commerce appeals to all men of goodwill to assist: "in establishing definite policies of action with a view to placing Canada in a sound commercial position in the forefront of the race that is to come, for foreign markets."

With a view of bringing France's timely reminder to the attention of the Government and at the same time of answering, in a modest way the appeal of the Minister of Trade and Commerce, the undersigned, who are members of the Canadian section of France-Amerique, beg to submit the following suggestions which they trust, in a measure, will be found effective to bridge over the perilous transitory period which will follow the cessation of hostilities.

They respectfully recommend that the Government appoint an Honorary Commission assisted by experts, if needed, for the purpose of:

A.—Ascertaining what products could be furnished for the work of reconstruction in France.

B.—Selecting speedily from such products material required in large quantities and which after having been standardized could be produced at home on the same scale. Such selection could be made with regard to our natural resources, to the adaptability of our normal manufacturing equipment and to the possible transformation of our factories for war material.

C.—Negotiations with the French Government with a view of having France, as a nation, purchase large quantities of such standardized products with the understanding that the orders for such materials would be handled by Canada in the same manner and through the same channels as war orders have been up to date.

D.—Advising as to the best means of adapting our normal manufacturing equipment and transforming our munition factories to produce the standard goods above referred to.

When in possession of the information so furnished by the Commission, the Government could, through the War Purchasing Commission or a special commission to be appointed for the purpose, as found advisable, contract from time to time, with the French Government for the sale of such products and in so doing feed our National Industry with peace orders as it has done with war orders and fill with profit producing goods and ships chartered to repatriate our soldiers and which otherwise would sail back to Europe with empty hulls.

That Canada, by such method, could compete in the open markets of the world, is shown by the fact that our home industries have produced and sold war material at a lesser price than was obtained in Great Britain and the United States.

That large orders can be secured from France is demonstrated by our present large exportations, a substantial portion of which is not composed of war material. This can be further established by enquiries to purchase large amounts of goods made by the French Government to Canadian manufacturers, through members of this very Committee, copies whereof are appended hereto. As will be seen, one of these enquiries refers to large quantities of various metal, lumber products and other goods, many of which are, at present, being imported by France from Canada. The other refers to a huge amount of a highly finished product, viz. no less than 250,000 miles of metal.

A letter joined herewith will be useful to show the value of standardization. It refers to our own market in ready-made wooden doors which for a long period was dominated by standardized American goods, although such foreign goods are often made with Canadian lumber and were always burdened with the cost of a long railway haul and of the Canadian duty.

The undersigned refrain from elaborating further on the possibilities of the plan suggested but in submitting the same respectfully to the earnest consideration of the Government beg to remain at its disposal for any further information concerning this matter.

For the Committee on Franco-Canadian Trade Expansion.
C. P. BEAUBIEN, President.
EDOUARD MONTPETIT, Secretary.

The committee, which has been at work for some three months on the subject, includes some of the most prominent representatives of commercial, engineering, banking and railway interests in the city of Montreal. The following are members of the committee: Hon. C. P. Beaubien, president; E. L. Pease, vice-president; Edward Montpetit, secretary; Lord Shaughnessy, Hon. F. L. Beique, Sir Herbert Holt, Hon. R. Dandurand, H. G. Kelley, Sir Hormidas Laporte, Sir Herbert Ames, Emilieu Daoust, G. Gonthier, Beaudry-Leman, Leon Lorrain, Henry Miles, L. N. Patenaude, Frank Pauze, O. S. Perrault, J. Quintal, Paul Seurot, A. Surveyor, E. Fabre-Surveyor, Alfred Tarut, J. R. Genin, E. H. Vautelet.

This open letter was accompanied by two other communications, one by Professor L. A. Herdt, of McGill University, Montreal, the other by Mr. Paul Seurot, a well-known Montreal engineer. These letters follow:

Hon. C. P. Beaubien,
President, Committee: Franco-Canadian Trade Expansion, France-Amerique, 180 St. James Street, Montreal.

As a member of your committee, I beg to advise you of a request sent to the Consul General for France, early last September, by the French State Railways, for railway material of all kinds and which was referred to me by the consulate.

Acting on behalf of the Consul General, I therefore made enquiries as to the possibility of securing such material, a list of which is attached hereto; and presumably for a very large order, having in view the renewal of the major part of the State railways rolling stock. The transportation of this material to France could probably be secured by Government requisition, either from New York or Halifax.

With this I also send a second list of articles about whose supply enquiries have been received from France during the month of September at the French Chamber of Commerce of Montreal and brought to my notice.

This will show that, in spite of the activities of commercial representatives from the United States, in France, there is a large market open there for Canadian goods and enterprise.

Yours very faithfully,
(Signed) Paul Seurot.

List of Material Required by the French State Railways

Wheels for locomotives.
Wheels for freight and passenger cars.
Straight axles for locomotives, freight and passenger cars.
Bent axles for locomotives.
Locomotive steam cylinders.
Cast steel lubricating boxes.
Cast iron lubricating boxes.
Iron, bronze and brass castings.
Round, flat and square steel bars.
Steel castings.
Steel billets, spring steel.
Helicoidal and spiral springs.
Steel shapes.
Spikes, cut and wire nails.
Iron fittings, spare parts for freight and passenger cars.

Copper and steel fire box plates.
Rails, bars and splices.
Traction chains and hooks.
Drawn and seamless steel, copper and brass tubes, straight and bent, from 1 m/m to 250 m/m in diameter.

List of Articles About Which Enquiries Have Been Received During September at the French Chamber of Commerce

Shoes.
Hardware.
Lumber.
Foodstuff, canned goods.
Prepared furs.
Glassware for electric light.
Lard, bacon and smoked ham.
Toys.
Maple syrup.
Tree felling and cutting machines.

Hon. C. P. Beaubien,
President, Committee: Franco-Canadian Trade Expansion, France-Amerique, 180 St. James Street, Montreal.

Dear Sir:—

Acting for the French Purchasing Commission of New York, I have placed, in Canada, within the last two years, orders for very large amounts of various metallurgical finished products.

To give you an idea of the importance of these orders, I may state that I received once an enquiry for no less than 250,000 miles of cable, a highly finished metallurgical product, exceeding in price $10,000,000, and in length ten times the circumference of the earth.

Yours very truly,
(Signed) L. A. Herdt.

Standardization of Required Consistency for Asphalt

By J. R. Draney*

ABOUT three or four years ago the writer contributed an article regarding the many varieties of penetration required in the production of asphalt for paving purposes. At that time it was set forth that the demand upon asphalt refiners for so many different penetrations of asphalt was an undue hardship and one which, from a practical viewpoint, was totally unnecessary. For example, under similar conditions, one city will prefer a penetration of from 60 to 65, while another city will require a penetration of from 55 to 60 or 65 to 70, and there are some cases where a penetration of from 70 to 75 has been required for sheet asphalt. Penetrations of from 35 to 40, 40 to 45, and 45 to 50 are also required.

There is also a variation in penetration requirements for asphalt to be used in asphaltic concrete, but these variations do not cover as wide a range as the asphalt required for sheet asphalt work. Penetration requirements for asphaltic concrete range from 60 to 65, 65 to 70, 70 to 75 and 75 to 80, and in some cases between 80 and 90, but the latter is demanded only where asphaltic concrete carrying a goodly proportion of large-sized stone is used.

Asphalt to be used in asphaltic macadam by the penetration or pouring process, is likewise called for by the trade in penetrations ranging from 90 to 190. We have many instances where penetration of from 80 to 100 is demanded. Probably the penetration that is more largely required averages from 110 to 120. The specifications of the New York State Highway Department require from 140 to 190.

These wide ranges in penetrations for asphalt to be used in the same type of work are due principally to a lack of concordant ideas and are the result of individual tastes. It has caused a lot of extra work, expense, time, trouble and worry to asphalt refiners and during the present season has become more obnoxious than ever, due to the shortage of asphalt.

The company with which the writer is connected has manufactured asphalt in the last few years with penetrations covering a total aggregate of twenty different ranges for sheet asphalt, asphaltic concrete and asphaltic macadam. Quite often the refinery may have on hand a stock of asphalt with several ranges of penetration, but will be out of the penetration required for that "hurry up" order which must be shipped immediately. The contractor is awaiting the material, but we dare not ship anything but the penetration within the range that he has ordered, as the authorities under whom he is working would not permit it to be used.

The war has impressed upon all of us the pronounced need for greater efficiency and economy. Therefore, why the necessity of producing so many different varieties in a material when there is no real excuse or reason for it except that of individual ideas?

Co-ordination of ideas, with a resultant standardization should be realized. We trust that the American Society for Municipal Improvements will inaugurate such a movement affecting the use of asphalt for paving and that other societies will follow suit.

There are but three varieties of penetration necessary for sheet asphalt, one for streets with heavy traffic, one for moderate traffic and one for light traffic. The same may be said of asphalt required for asphaltic concrete pavements. For asphaltic macadam there should be one range of penetration and that a fairly wide one. For example, a specification giving a penetration requirement of from 100 to 125 would cover the matter properly and effectively.

The matter should be given serious thought, and we hope for concordant action which will result in a practice that will make for increased efficiency and economy, and at the same time secure a much needed standardization in the consistency of asphaltic material for paving purposes.

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*Before American Society Municipal Improvements

A Glass House Boat

The world's first glass boat house is being built for Mr. Lee M. Rumsey's winter home at Alton Beach, Miami, Florida, adding another item of interest to the many yachting novelties of this sub-tropical region. Glass has been widely used in the construction of conservatories and swimming pools; however, its application to boat houses comes as a distinct novelty, though, when its advantages for this purpose are considered, it is a wonder no one thought of it before. The structure is of pleasing line, with curved eaves, and with the roof and sides constructed of glass there is little chance of mildew. It can be washed down with a hose from top to bottom. There is not a dark spot in the whole structure. The supporting framework is of cast iron and steel, heavily galvanized. The glass used in glazing is ground, which softens the direct rays of the sun, while giving the maximum amount of light. The double doors are of wood, with an open lattice pattern that insures good air circulation. In designing the structure, the architects aimed to secure conditions approaching a boat at anchor, with a suitable covering to shield it from the weather. The foundation is of concrete. A toilet and storage closet are provided at one end.

Poplar averages up about the same on the whole as the coniferous woods, such as cedar, cypress, hemlock, pine, etc.

Toronto Building Interests Prepare for the Ottawa Convention on Nov. 26, 27 and 28

A MEETING was held on the afternoon of Wednesday, Nov. 6th, at the headquarters of the Toronto Builders' Exchange, to discuss the plans for the Ottawa conference of building interests, to be held Nov. 26, 27 and 28. Mr. W. E. Dillon, president of the Exchange, opened the meeting, pointing out that its object was to help along the coming convention, and recalling the previous conference held in Toronto, at M. J. P. Anglin's suggestion, when a committee had been appointed for organization purposes. He also explained that a later meeting had been held at Ottawa, on Oct. 7, which had been attended by Mr. A. H. Dancy, of H. N. Dancy & Son, Ltd., Mr. G. E. Stocker, of Jas. A. Wickett, Ltd., and himself as Toronto representatives. He then requested Mr. Maxwell to take the chair, and Mr. Dancy was called upon to present a report regarding the meeting in Ottawa.

Mr. Dancy reviewed the events which had led up to the Ottawa meeting, and pointed out that the movement had aroused such interest as to receive lengthy write-ups in the Contract Record and other technical journals. To make the situation quite clear to those not already fully acquainted with the facts. Mr. Dancy read extracts from the articles mentioned, dwelling on the objects to be obtained by the organization, the incentive to its formation, its precedent—the similar movement in the United States—and the backing which it had received. Mr. Dancey then proceeded with an account of the transactions at the meeting in Ottawa, which he and Mr. Stocker had been requested to attend in place of Mr. Elgie, who had other important engagements. It opened on the morning of Monday, Oct. 7, there being three reprensentatives present from Montreal, three from Ottawa, one from London, and three from Toronto. A letter had been read from Calgary, in which it was stated that they were not well organized there, but had been planning a western association.

There were three important questions, which the writer submitted should be brought up at the conference: (a) A general form of contract; (b) a standardized clause in contract re architects and arbitration; (c) a definite platform on the labor problem.

In regard to the registration at the conference, it has been arranged to use cards of three different colors, to distinguish sectional membership, giving name, firm, business, address, and classification, and it was recommended that firms having two classifications send one of each. Buttons were also to be provided on presentation of the cards.

It was agreed that a preliminary contribution of $500 was necesary before the holding of the conference, and it was suggested that the various exchanges forward a fair proportion without assessment, thus evidencing faith in the ultimate results of the organization. A further appeal would be made at the conference to those who had not already subscribed. The Montreal exchange had promised $200 towards this amount.

A sub-committee on arrangements had been appointed, consisting of Messrs. J. P. Anglin, D. K. Trotter, and G. A. Crain, treasurer, 178½ Nepean St., Ottawa, to whom subscriptions should be sent.

Regarding the discussion on the order of business at the conference, Mr. Dancy referred to the small preliminary notice and programme which has already been issued. It was proposed in the first place that a stand-up roll call and count be made. And as to the organization of the convention, the officers recommended were: chairman, vice-president; honorary-treasurer, honorary secretary, and convenors or sections. It was suggested that the publicity committee be composed of four members, one for each section, and one general representative, and the proposal was also made that a committee be appointed in each town or city to see the prominent men of the trade in the locality and urge their co-operation and attendance. In this connection, too, it had been resolved to issue the small folder referred to above, which has already been distributed, and to supply stickers for mailing use by individual firms.

Arrangements were made to prepare forms for all resolutions, and to have them signed by mover and seconder before presentation to the conference.

It was further suggested that a few public men be invited to address the conference, and that the business sessions close at noon on the third day, so that the delegates would have an opportunity of seeing the city. Plain war-time luncheons (self-pay) are to be the order, the arrangements being left to Mr. Mattice of Ottawa. It was also recommended that the Ottawa local men supply their own staffs for clerical work, so as to avoid all unnecessary expense.

Mr. Dancy proceeded to make some remarks as to the urgent need for the protection afforded by such an association as it was the object of the Ottawa conference to bring about, citing a case in Toronto, where a contractor had paid out $7,500 in excess of his estimates due to the increase in freight rates since the contract was signed. The irony of the thing was that the railway company which received the freight rates, was also the owner, and apparently there was no redress.

He pointed out that in the United States many large contracts are now being converted to the cost-plus basis, thereby guaranteeing the contractor against losses resulting from conditions beyond the possibility of foresight, and at the same time ensuring the owner a fair return for his outlay, presupposing, of course, the strictest honesty and fair dealing on the part of the contractor, for which at present, it must be admitted, owing in many cases to grossly harmful prejudice, the profession or calling is not particularly far famed.

Mr. Dancy was congratulated on the excellence of his report, which was unanimously received. The chairman then called for discussion in regard to the coming conference.

Mr. Elgie felt that if there was ever a time in Canada when contractors and supply men had strong reasons for getting together, it was right now. If the contracting business was to be any good to its members in future, they would have to put something into it. They would have to make themselves felt and recognized. Surely it was possible to make contracting a business a man might be proud to follow. The contractor has never thought it worth while to stand up for his rights. Any man outside the trade can get materials just as cheaply as the contractor. The plumbers know how to protect themselves and the manufacturers know how to protect themselves, and it was up to contractors to let the Dominion of Canada know they were doing something and that they intended to stand by each other. If men from all over Canada would get together at the proposed conference, benefits would certainly result. The government would know that some action was being taken by the contractors and would do something for them.

Mr. Dillon pointed out that it was desired to have all branches of the trade represented at the conference. The plumbers had accidentally been overlooked in the invitations to the previous organization meeting, but he hoped they would help along by their presence at the Ottawa conference.

Mr. McIntyre, of McGregor & McIntyre, Limited, who had been invited to attend, had some pointed and forceful remarks to make, and also some criticisms, which were, however, of a helpful nature. He said he was delighted that the initial steps had been taken in connection with the new organization and that he was fully in accord with the movement. There never was a time when such a movement was more needed and when the country was more ready for it. He pointed out that the Government was taking steps in the organization and assistance of industry. In the metal industries, firms were confronted with a famine of raw materials, and the War Board had taken the matter up. As a result the Government was taking over the idle furnaces, and every pig iron furnace in Canada would be put in operation. It had asked the manufacturers to get together and, contrary to its previous policy, was advocating the cutting out of competition. Plants would be located in certain districts, and each would have a monopoly of a certain class of materials in its district, the object being to permit them to compete with other countries.

Mr. McIntyre drew comparisons between the organization in the building and in other industries. In the Manufacturers' Association, of which he was a committee member, they had invested considerable money in their organization and they got returns. Not only had they committees on every question of interest to the manufacturer, but they had trained experts. For instance, in case an increase in freight rates were proposed, every member of the association was advised of the situation, and there was an expert in that line to take the matter up. Contractors had no such protection, and thousands of dollars had been lost through the rottenness of the contracting business in Toronto.

Most of the contractors, Mr. McIntyre said, were afraid to put up the money. There was enough money in Toronto to run an adequate organization, and he saw no reason why a suitable building should not be erected to give some dignity and strength to the association. An office building would cost money and might not pay big returns, but it would be worth while in other ways.

Mr. McIntyre's criticisms drew forth replies from some of the officers of the Exchange. Mr. Dillon said they had not been as inactive as Mr. McIntyre seemed to suppose, and pointed out that they had been working along various lines to protect their interests.

Mr. Maxwell complained of the manufacturers' attitude, stating that they had given credit to every Tom, Dick and Harry, and had thereby greatly injured the standing of the contracting business. It was necessary, he said, to get a better feeling between manufacturers, supply houses and contractors.

Mr. Thompson, of Thompson Bros., also spoke supporting the organization movement, and recommending that the Toronto Exchange should hold its own in the mater of subscription to the funds.

Representatives of the painters' association who had been invited to attend, expressed themselves as heartily in accord with the conference proposal.

Canadian Contractors and After War Business

NOW is the time for Canadian contractors to prepare for after-the-war-business. Many of them are doing so individually, and the proposed Ottawa conference is an indication that they intend to take united action for the protection and furtherance of their interests. The question uppermost in their minds, of course, is: will the building trade be advantageously affected, and in what line will there be the greatest activity?

It is not safe these days to make any definite predictions, but it does not seem to us that the arrival of peace will have any marked effect upon the trade. New industrial buildings, which, of necessity, fill the greatest part of our construction field, will not be required in any great number, as with the cessation of munition work hundreds of plants will be made available for adaptation, temporarily at least, to other purposes; and manufacturers will naturally make use of these buildings until conditions become settled and the wheels of industry are again running in their normal grooves. During this period of readjustment, therefore, contractors can look for little activity in the construction of industrial plants.

There are other lines, however, to which the close of the war will probably give considerable impetus. Government and municipal work of all kinds, much of which has been held in abeyance for the last few years, will no doubt be proceeded with almost immediately. Road and paving work, sewerage and waterworks, power developments, bridge work, schools, hospitals and public buildings for various purposes—these are needed and must be provided with little delay. Road work, according to all indications, will go ahead by leaps and bounds, and contractors in this line will have big opportunities.

There is another field, in which, if we judge the signs of the times aright, there is going to be rapid development, namely, industrial housing. Industrial housing schemes, we believe, will be undertaken very widely throughout the country, both by private concerns and municipal authorities. This will be rendered necessary in order to relieve the housing shortage and indeed, aside from this consideration, manufacturers, and employers, generally, are beginning to realize the value of these undertakings as a means of holding their employees and keeping them fit and efficient, while workers, on their part, are demanding better living conditions for themselves and their families. Here, then, is a wide field for the building contractor, and he must be prepared to handle the work.

The annual meeting of the general contractors' section of the Montreal Builders' Exchange was held on November 5th, with M. W. C. Munn in the chair. The financial statement showed a balance on the right side. The following were elected officers: Chairman, Mr. John Quinlan, John Quinlan & Son; vice-president, Mr. W. M. Irving; hon. treasurer, Mr. H. Fussing, Fussing & Jorgenson; executive committee, Messrs. W. C. Munn, Munn & Shea; and R. MacLean, the James Shearer Co., Ltd.

Mainly Constructional

East and West—From Coast to Coast

Fraser, Brace Shipyards, Limited, has been incorporated, with a capital of $750,000, head office in Montreal.

An increase in the capital of Halifax Shipyards, Limited, has been authorized, from six million to ten million dollars.

Building permits issued in the city of Winnipeg during October totalled $95,000 in value, as compared with $72,300 in the same month last year.

The Brant county council have decided to purchase the Brantford-Paris toll road at a price of $4,000. The city of Brantford will contribute $1,000.

The Chatham waterworks commission proposes to instal a laboratory in order that daily bacterial tests can be made of the city water which, for some time, has been under suspicion.

Good progress has been made on the Glen road subway in connection with the Bloor street viaduct. The piers and top sills are in position and the work on the bridge flooring has been commenced.

The U. S. and Canada Transport & Trading Co., Ltd., has been incorporated, with a capital of $2,500,000, head office in Toronto, and is authorized to carry on the business of shipbuilders and shipowners, generally.

A holiday is to be proclaimed in Winnipeg to celebrate the opening of the new aqueduct. The event will take place some time in the latter part of December, and all institutions in the city will be asked to co-operate in making it a red-letter day.

The Campbell Milling Company are preparing to enlarge their premises at Cawthra Ave. and Junction Road, Toronto, and have taken out a permit for the erection of a reinforced concrete grain elevator and storage tanks, at an estimated cost of $130,000.

Building Inspector Piper reports London's building permit issues as follows: October, 1918, value $277,650, number 81; October, 1917, value $143,450, number 77; total for ten months 1918, value $737,990, number 713; total for ten months 1917, value $718,290, number 749.

Six steamship contracts have recently been let by the government as follows: two vessels of 5,100 tons and one of 4,300 tons, Wallace Shipbuilding Co., Vancouver; one 3,750 ton vessel, Kingston Steamship Company, Kingston, Ont.; two 3,400-ton vessels, Port Arthur Steamship Company.

Building permits issued in Welland, Ont., during the month of October amount to a value of $16,525, as compared with $21,004 in the same month last year. This year's total up to October 31 is well ahead of the corresponding period of 1917, the figures being $418,004 and $226,184 respectively.

Toronto's building permits for the first ten months of 1918 reach a very fair total, $7,533,010, an increase of $1,157,931 over the corresponding period last year, when the figure was $6,375,079. The value for October this year is $781,201, as compared with $786, 225 in the same month in 1917.

The Meagher, Ross Contracting Co., of Ottawa, is pushing work ahead very rapidly on the new military depot building at North Rosedale, Toronto. The contract was let on October 1 with a time limit of 90 days, and in less than half that time the barracks will, it is said, be ready for occupation.

Vancouver's building permits for October number 76 and are valued at $70,825, as compared with 71 at a value of $233,975 for the same month last year. The total for the ten months of 1918 is 729 permits, at a value of $1,287,993. This is a considerable increase over the corresponding period of 1917, when the total was 447, valued at $676,885.

Good progress is being made in the erection of two machine shops which are being added to the plant of the Galt Machine Screw Co., Ltd., Galt, Ont. One extension is 64 x 120 ft. and the other 70 x 76 ft. Both are one-storey structures and of brick construction. Sibley & Miller have the contract for the mason work and E. C. Hammill for the carpenter work.

Personals

Mr. C. V. Putman, assistant waterworks engineer, Ottawa, has resigned to take a position with the efficiency department of the Civil Service Commission.

Captain C. S. L. Hertzberg, M.C., of James, Loudon & Hertzberg, Ltd., has left Vancouver as a Conducting Officer in charge of an Engineering Company which has gone to Siberia to prepare quarters for Canadian Expeditionary Forces in Siberia.

Major T. R. Loudon, of James, Loudon & Hertzberg, Ltd., who was recently invalided from France to Canada, has been appointed Commander of the Royal Canadian Engineers in Military District No. 11, which includes British Columbia and Vancouver Island. This appointment carries with it the responsibility of all the engineering work done by the military authorities in this district.

Mr. Paul E. Mercier, for many years chief engineer of the city of Montreal, and director of public works, has been appointed consulting engineer of the city. He is succeeded as director of public works by Mr. A. E. Doucet, civil engineer, who has been engaged by the city since July in supervising engineering work. Mr. J. R. Barlow, for many years engineering superintendent of the road department, who retired some weeks ago, has been granted a pension.

Geo. F. Sheppard has joined the sales staff of the Canadian S K F Company, Limited, Toronto, and will be in charge of the Montreal office, 128 Coristine Building. He will handle the well-known S K F and Hess-Bright Ball Bearing and also the product of the Atlas Ball Company. Mr. Sheppard has had a wide experience in the engineering field and was recently power sales engineer for the Northern Electric Company, Montreal, while for some time previously he represented the Canadian Hoskins Company of Walkerville, Ont., in Montreal.

Obituary

Mr. Allan McCarthy passed away recently at his home in Toronto, as a result of pneumonia following the influenza. He had been a house-moving contractor in Toronto for the past eight years, coming from Peterboro.

Mr. Harold Thompson, who had been a mining engineer with the Hollinger Mines, Timmins, Ont., died there of pneumonia recently, following a brief illness. The late Mr. Thompson was born in Toronto, but lived for a number of years at Kingston, Ont.

Mr. F. C. DeGuerre, a young engineer who early this year formed a partnership with Mr. Robt. M. Matheson, architect, of Vancouver, B.C., died recently after a brief illness. The late Mr. DeGuerre was a native of Galt, Ont., and in 1911 obtained the B.A.Sc. degree in the Faculty of Applied Science and Engineering, Toronto. Going to British Columbia in 1912 he was for some months associated with the city engineer of North Vancouver, and later joined the engineering staff of the Granby Consolidated Mining, Smelting & Power Company.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Toronto, Ont.
Tenders are being received by chief architect, R. C. Wright, Ottawa, until November 16th, for tile drains and the trenching and laying of 6 in. water mains at Rosedale Barracks.

CONTRACTS AWARDED

Cap De La Madeleine, Que.
Work has started for concrete culvert costing $4,000 for Department of Roads, Quebec: General contractor, A. Beaudry, 60 Ste. Cecile St., Three Rivers.

Three Rivers, Que.
Concrete sidewalks costing $5,000 for City Council: General contractor, Dallaire & Pothier.

Railroads, Bridges and Wharves

Grand Mere, Que.
Plans have been prepared for bridge for Laurentide Co.

Walkerton, Ont.
County Council contemplates laying roads. Engineer, F. James.

Welland, Ont.
Tenders are being received until 4 p.m., November 18th, for strengthening Welland river bridge, costing $5,000, for City Council. Clerk, Miss C. M. Stapf.

CONTRACTS AWARDED

Shawinigan Falls, Que.
Repairs to two bridges costing $8,000 for City Council: General contractor, N. E. Germain.

Toronto, Ont.
Verrocchio & Castellani, 53 Greenlaw Ave., have the contract for grading railway tracks for C. N. Rly.

Winnipeg, Man.
Work has started for business block costing $60,000 for C. P. Rly.: General contractor, R. Crawford, 118 Sherbrooke St.

Public Buildings, Churches and Schools

East St. John, N.B.
Tenders are to be called shortly for frame balconies costing $8,000 for Department of Public Works, Ottawa. Architect, F. Neil Brodie, 42 Princess St.

Halifax, N.S.
Plans are in progress for two schools for Halifax School Board. Architect, Wm. Fraser & Harold S. Kaplan, St. Paul Bldg., Barrington St. & 34 Victoria St., Toronto, Ont.

Hamilton, Ont.
By-law is to be submitted for the construction of market shelter costing $25,000 for City Council. Architect, L. Munroe, cor. Hughson & Main St.

Neerlandia, Alta.
Tenders are being received by Sec.-Treas., C. Ingiversen, until November 20th, for the erection of frame school for Shoal Creek S. D. No. 3460.

Ottawa, Ont.
Plans are drawn for a two-storey addition to military hospital for Department of Public Works, Ottawa. Chief architect, R. C. Wright, Robinson Bldg.

Plans are in progress for alterations to heating system for Department of Public Works, Ottawa.

Ponoko, Alta.
Tenders are being received by L. C. Charlesworth, minister of Department of Public Works, Edmonton, until noon November 18th, for the construction of male dormitories costing $85,000, and dining hall costing $35,000 for Provincial Asylum.

Rodina, Alta.
Tenders are being received by Sec.-Treas., Albert Skaife, until noon, November 20th, for the erection of school for Willow View S. D. No. 3510.

Welland, Ont.
By-law is to be submitted in January for permission for Fire Co. to spend $60,000 for new fire hall and fire fighting appliances.

CONTRACTS AWARDED

Halifax, N.S.
Work has started for a 2½-storey, frame hut for Y. M. C. A., Barrington St.: General contractor, Thomson & Theakston, 116 Hollis St.

Montreal, Que.
The following contracts have been awarded in connection with the erection of a $30,000 addition to home for Montreal Khaki League, 660 Dorchester St. W.: Roofing, Douglas Bros., 19 St. Maurice St.; electrical work, Canada Electric Co., 250 Beaver Hall Hill; plastering, R. D. Clarke & Sons Ltd., 26 Lincoln Ave.; painting and glazing, W. J. Ryan, 32 Fort St.

Walls are being erected for Italian church costing $143,000 for Parish of Notre Dame De La Dedece: Lath work, Daniel Murphy, 3042 Berri St.; plastering, Decorative Plastering Co., care of general contractor, John Dominique, 237 Addington Ave.; glazing, Hobbs Mfg. Co., 444 St. James St.

North Sydney, N.S.
Foundations are going in for aviation camp costing $207,000 for Department of Public Works, Ottawa: General contractor, Bate McMahon & Co., Central Chbrs., Ottawa, Ont.

Foundations are going in for barracks and mess building costing $114,000 for Department of Public Works, Ottawa: General contractor, E. M. Dixon, Louisburg, N.S.

Ottawa, Ont.
The following contracts have been awarded in connection with the erection of a $175,000 addition to technical school for Ottawa Collegiate Board: Plumbing and ventilating, W. G. Edge Ltd., Boorth Bldg.; plastering, Murphy & Morrow, Billings Bridge; marble and tile, A. K. Mills & Son, 191 Sparks St.; electrical work, Marchand & Donelly, 128½ Sparks St.; galvanized iron and waterproofing, McFarlane & Douglas, 250 Slater St.

Shoal Lake, Man.
Foundation is in for a $4,000, frame church for Anglican Church Congregation: General contractor, W. J. Matchan.

Waterford, N.S.
Church costing $21,000 for Presbyterian Congregation: Electrical work, R. J. McDonald; plumbing, Thompson & Sutherland, North Sydney.

West St. John, N.B.
Alterations to hospital for Department of Public Works, Ottawa: General contractor, J. H. Doody, 16 Canterbury St.

Business Buildings and Industrial Plants

Alliston, Ont.
Foundation is going in for a $7,000, one-storey, cement block creamery for Hutchinson & Foster.

Biggar, Sask.
McKinley & Mitchell contemplate the erection of business block which was recently destroyed with loss of $10,000.

Edmonton, Alta.
Northland Oil Syndicate contemplates improvements to oil plant. Address, Mr. Schmid, Box No. 301, Edmonton.

Evansburgh, Alta.
Work has started for twenty-five room addition to hotel for North American Colleries, Edmonton.

Grande Riviere, Gaspe, Que.
La Banque Nationale, Quebec, contemplates the erection of a $12,000 bank. Architect, Pierre Levesque, 115 St. John St., Quebec.

Kingsville, Ont.
Site has been purchased for a warehouse costing $5,000 for New California Co-operative Club. Address, Secretary.

Lethbridge, Alta.
Work has started for a $65,000 extension to plant for Imperial Oil Co. Ltd., Sarnia, Ont.

London, Ont.
McClary Mfg. Co. contemplate exten-

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The Re-establishment Problem — Shall We Act or Drift?

NOW that the war is over and won, the vital problem in Canada is the re-establishment, in civil life, of the men who will no longer be required in war work and of the further thousands that will return from overseas. The latest announcement is to the effect that munition work will cease within a month and this will release a force of semi-skilled labor variously estimated at twenty-five to a hundred thousand. It is also semi-officially stated that demobilization of the forces of the overseas dominions will proceed forthwith, the work of occupation and policing of Europe being left in the hands of European troops, supplemented, no doubt, by United States forces, on account of the shorter length of time they have been in the war.

Within a month then we must be in a position to absorb, say, fifty thousand men and, within a year, perhaps three hundred thousand more. Are we ready?

There is little doubt that plenty of construction is in sight if our organization is sufficiently consolidated to handle the problem. Take for example the Toronto harbor work, the Chippewa development, the Welland Canal, to say nothing of good roads building, which in itself, under a vigorous policy, could absorb a large percentage of the extra labor. Shipbuilding, too, though comparatively a new industry in Canada, bids fair to develop into one of our most important. Last and not least, there are the vast areas of untilled soil which offer splendid opportunities, since the demand for food products must inevitably be very great for some years to come—with correspondingly high prices. These are merely suggestions of almost limitless possibilities, if the situation is handled aright.

It is most opportune that the building interests of the Dominion are meeting in convention in Ottawa in the near future—November 26, 27 and 28—for there can be no doubt but that their better organization would greatly assist the Government in the solution of this re-establishment problem. We suggest, in this connection, that these interests appoint a strong committee to advise with the Government as, doubtless, building contractors and supply men possess the very information the Government will be in need of.

Can there be any question but that we are face to face with one of two alternatives: Either we must immediately provide lucrative employment for a large number of workmen, or, face a period of depression due chiefly to unemployment. Which shall it be?

A Precedent for the Canadian Association of Building Industries

A PRECEDENT is always helpful, because it gives one the opportunity of profiting by someone else's experience. The Canadian Association of Building Industries has a precedent in the National Federation of Building Industries, and a thorough consideration of the methods used and the lines followed by the latter organization will undoubtedly be of assistance to Canadian building men in the formation of their association. Many of the trade on this side of the line know little about the National Federation, and we think it opportune, therefore, just preceding the Ottawa conference, to give an outline of this organzation. It was formed at a conference held at Atlantic City, July 15 and 16, this year, the business placed before the delegates being: "To consider ways and means whereby the various divisions of the Building Industries can find a common ground upon which they may give co-ordinate assistance to the government during the war: to develop machinery whereby the industries can speak with a united voice upon matters affecting all interests involved, and consider plans for the re-establishment and maintenance of the general prosperity of the industry as a whole." It will be seen that the main object of the Federation was to promote the winning of the war, through co-operation with the government. Now, however, that a victorious peace has been practically consummated, it seems that the first of the two main purposes of the Federation, as quoted, might be re-written to suit the present requirements of the situation in Canada, as follows: "To consider ways and means whereby the various divisions of the Building Industries can find a common ground upon which they may co-operate mutually and with the government upon the war and the promotion of Canadian trade and commerce both at home and abroad." The second clause of the National Federation's proposed business, as quoted above, is completely applicable to Canadian conditions, and states fairly concisely what may well be the object of the proposed association with regard to our own industries.

As stated above, the Federation was organized mainly to promote the winning of the war, which is now accomplished, but the machinery evolved is the result of deep study and hard work continued over many weeks previous to the conference by numerous committees, and we believe a perusal of the articles of association adopted will be of interest and value to those who are desirous of working up a strong organiation in Canada. These articles are given below:

It would hardly be practicable in Canada to follow the example of the National Federation in permitting only associations to become full members of the organization, because the industry on this side of the line is not well enough organized. It would seem, however, that it would be well to form a committee such as the War Service Committee, representing the various districts of the Dominion, and also a smaller executive board to carry out any programme outlined by such a committee. Our country is so large and our population so scattered that executive work must of necessity be placed in the hands of a few.

There is one point which we would like to emphasize in regard to the conduct of the conference at Ottawa—the necessity of the spirit of co-operation and the forgetting of past disputes, difficulties and injuries, real or supposed. The words of Harry A. Wheeler, president of the U. S. Chamber of Commerce, who addressed the Atlantic City conference, are particularly pointed in this connection:

"Now, what has to be done is this, and in this opening session I want to leave with you this particular caution: Won't you, no matter what may be your previous notion of your competitors or of others in other lines of trade, no matter what grievances you may have suffered, no matter what jealousies may have existed, no matter what suspicions may have at some time crept in as between the industries, won't you this morning cast them aside, accept each other for one hundred per cent honest purpose to perform a great patriotic deed in this convention, forget the past and stop looking backward, and look only ahead to the days that are before us, days in which we have enough of suffering and enough of difficulty so that we cannot afford to harbor any ill-will or any ill-feeling or any unwise counsel with respect to past actions, but only looking out into the future for the thing that will be best for the nation as a whole?"

1. A voluntary association to co-operate with the United States Government in carrying on the war, to co-ordinate industrial activities and to conserve resources, shall be and now is created to be known as the National Federation of Building Industries, referred to hereinafter as the Federation.

2. The Federation shall be managed and its policies devised and carried out by a body of delegates to be known as the Building Industries War Service Committee, referred to hereinafter as the War Service Committee.

3. Any association of building material manufacturers or dealers, or of contractors engaged in building, or of architects or engineers, or any association of other persons, firms or corporations related to building, may become a member of the Federation and be represented in the War Service Committee upon the following conditions:

(a) Members may be either national associations or regional associations.

(b) A national association is an association composed of members whose places of business are located or whose products are distributed at large over the United States.

(c) A regional association is an association composed of members whose places of business are located and whose products are distributed principally in a single city, district, locality, state or region.

(d) Each national association shall be entitled to three delegates and three votes in the War Service Committee, and each regional association one delegate and one vote in such committee. If less than three delegates are present from a national association they may cast the entire vote of such association.

(e) Each national association shall contribute $300, and each regional association $100, to the organiation fund, in both cases payable ten days after notice of election and there shall be no dues prior to January 1, 1919.

(f) The admission and classification of any association shall be made by the Committee on Credentials, to be appointed from the War Service Committee by the President. The War Service Committee may review the action of this committee.

(g) At least one delegate from each member association present at any meeting of the War Service Committee shall be some other person than a paid employee of such member association.

Vacancies may be filled by the Executive Board until the next regular or special meeting of the War Service Committee.

Vacancies in the Executive Board may be created by a two-thirds vote of the members of the War Service Committee present at a regular meeting and may be filled by them when created.

6. The Executive Board shall elect annually by majority vote to serve one year, a president of the War Service Committee, who shall be chairman of the Executive Board, and shall also elect a vice president and treasurer of the War Service Committee, and these officers shall serve without salary.

7. The Executive Board shall appoint, to serve during their pleasure, an assistant to the president and fix his compensation. He shall be the staff representative of the president and of the War Service Committee. Subject to the approval of the Executive Board, or of such committee as they may establish for administrative supervision, he shall provide, maintain and conduct offices, facilities and staff and shall cause the Board or its committees to be provided aid in their inquiries and negotiations and to be furnished reports upon subjects with which they are to deal, and staff service in framing and declaring policies. He shall cause members of the federated bodies to be provided with means and advice for prompt consideration of matters which they desire to have considered by the Executive Board, or for prompt action insofar as such matters involve precedents already adopted by the Board, and he shall in general be charged with the promotion of the aims of the organization and the co-ordination of its constituents for results.

8. The War Service Committee shall meet on the first Monday in November, 1918, and quarterly thereafter, and not less than ten days' notice shall be given of the place and hour of each such meeting. One of such meetings shall be designated as the annual meeting and the Executive Board may arrange for such larger attendance of representatives of the member associations as they deem fit, without however, changing the ratio of voting as hereinbefore provided.

9. The Executive Board shall maintain facilities for continuous communication with the individual members of the several trades and occupations through the member asso-

ciations and shall provide that the Board shall at all times know what are the practical problems and needs in the several regions, that the members of the Federation everywhere may know accurately and promptly what the War Service Committee is doing and prepared to do, and that all concerned may have convenient means of co-operation for the common end.

10. The War Service Committee may pass By-Laws necessary and proper to carry these Articles of Association into effect, including power to fix the dues.

11. In the case of such industries which now have or later may establish individual War Service Committees to delegates from member associations representing such industries shall in appointing the three delegates to conventions of the federation select at least two of such delegates from members of the individual War Service Committee then representing that industry.

12. These Articles of Association may be amended by the War Service Committee by a two-thirds vote of those present at a regular or special meeting, notice of proposed change being given in writing twenty days before such meeting to every member of the War Service Committee.

President of National Federation of Building Industries Points Out Advantages of Organization

THE National Federation of Building Industries recently formed in the United States is an organization very similar, apparently, to that which is now proposed for Canada, in connection with which the building interests are meeting in convention in Ottawa on November 26, 27, 28. The president of this organization is Mr. Ernest T. Trigg, vice-president, John Lucas & Co., Philadelphia. Feeling that his experience would be of value to the Canadian building industries, we recently wrote Mr. Trigg for any suggestions which he thought might be of value to Canadians in their coming convention, one of the paragraphs of our letter being as follows:

"Would you be good enough to write us a brief outline of the organization and purposes of your Federation, such as might be useful to our Canadian building men in their deliberations at Ottawa? Perhaps, at the same time, you might offer a word of advice and encouragement, based on the results achieved and experience gained since the formation of your own organization."

We have a very helpful and prompt reply from Mr. Trigg, which throws a good deal of light on the circumstances surrounding and following the organization of the building industries in the United States. Particularly noticeable is the formation of an executive board in Washington, acting, presumably, in an advisory capacity to the government on any matters affecting the industry. Mr. Trigg's letter runs as follows:

Editor Contract Record,
Toronto, Ontario:

Our Federation was the result of a realization of the unfortunate situation in which the Building Industry, more perhaps than any other industry, found itself at the outbreak of the war. We were so disorganized as to fall short of the full measure of usefulness which might have been expected from organization and full knowledge.

A big industry making heavy demands upon capital, labor, materials and transportation, we were the obvious target for measures of economy. Without a common head and a common mouthpiece, we were at the mercy of conditions.

During the last two months, we have had an Executive Board spending much time in Washington. We are working in close contact and full accord with the Non-War Construction Section of the Industries Board, our relations with whom may perhaps best be expressed in the words of Chairman McLennan of that Section. He said:

"I will not undertake to submit to you every proposed measure which you may think affects your interests, but I shall be glad to confer with you on any proposed measure which, in my judgment, would affect the building industry as a whole.

"I will not promise to act upon all of your suggestions, but from past experience I feel sure that if you do not convince me I will convince you, so that whatever is done will be done by mutual agreement."

In accordance with the policy thus outlined we have made such suggestions as would in some cases mitigate needless hardships, and in all cases tend to give a constructive and encouraging tone to official bulletins and circulars; to lay less stress upon the things which were not to be done and more upon those things which it was expedient should be done. All this was of considerable benefit to the industry.

Now the work before us is reconstruction. We have been consumed with regret for our lack of preparedness for war. The best use of regrets is to keep them sufficiently in mind to avert similar regrets in future.

We have called a meeting at Atlantic City in conjunction with the War Service and reconstruction conference of the Chamber of Commerce of the United States. I can best place before you our plan by enclosing a draft of programme, which indicates in a general way our proposed line of effort. If this should afford any suggestion to your industry, I shall be most happy.

I take pleasure in extending to your Executive Board, or other representatives of your organization, an invitation to attend our meeting, at the Hotel Traymore, Atlantic City, New Jersey, December 7th. It is a one-day meeting and speech making will be reduced to a minimum, but our proceedings may possibly be of interest.

If such attendance should be decided upon, it would be well to give me prompt notice, in order that I may take steps towards securing hotel accommodation for you, as there will be several thousand in attendance at the Chamber of Commerce meeting which begins December 3rd and lasts throughout the week.

With best wishes to the Canadian industry for success in its efforts in this great work, I have the honor to remain

Sincerely yours,
(Signed) **Ernest T. Trigg,**
President.

Philadelphia, Pa., Nov. 14, '18.

The name of the Tiffin Waggon Company is known the world over and perhaps no less that of its worthy vice-president and general manager, Mr. William K. Shelly. Mr. Shelly's many friends throughout Canada will regret to learn of his death on November 4th, at his home in Tiffin. He was 74 years of age and, up to the last, one of the most active business men in his district.

The Reconstructed Plant of the Quaker Oats Company at Peterboro, Ont.

THE construction work on the new plant for the Quaker Oats Co., at Peterboro, Ont., has been completed and provides increased accommodation to that furnished by the plant which was destroyed by fire December 11, 1916.

The fire at the Quaker Oats Company's plant will be readily recalled. It started about 10.45 a.m., by an explosion in the dry house, but the exact cause of the explosion has never been determined. The fire spread rapidly through the mill and by 11 a.m. practically the whole plant was ablaze. The fire was so intense that bricks ran like molasses and metal machinery was a molten mass. The intense heat was the longest sustained on record and the concrete was completely dehydrated. An exhaustive report on this fire was published in the "Contract Record" of February 21, 1917.

The lay-out of the new plant extends in a general northerly and southerly direction on the site occupied by the destroyed buildings. The buildings comprise warehouses numbers 1 and 2, package building, oat meal mill, cleaner and dryer buildings, puffed goods building, feed mill, flour mill, workhouse, track shed, scale shed, storage tanks, boiler house and pump house, also a sub-station. The block plan illustration shows the location of the various buildings, roads, railway sidings, etc. The east group of buildings are of heavy timber and brick, standard mill construction, with the exception of the dryer section of the oatmeal mill, which is of structural steel and re-inforced concrete construction. The boiler house and pump room have concrete girders and concrete roof slab carried on brick exterior walls.

Old Stack Utilized

The old stack was left standing after the fire. This was retained by enlarging and reinforcing the foundation and putting a concrete jacket around the base up to the boiler house roof line and then veneering the chimney with one course of brick. The old top corbel was removed and the height of the chimney was increased 50 ft.

The west group of buildings are all of reinforced concrete construction, including the storage grain tanks, the elevator workhouse, flour mill, feed mill, puffed goods plant, warehouse number 2, and electric sub-station.

The decision as to the style of the structures to be used in the different groups of buildings was determined by the available supply and time of delivery of concrete materials and timber.

It was found that timber could be obtained if cars were available to load it on. To ensure delivery, the contractors purchased outright a sufficient number of second hand cars and by this means secured prompt delivery of the timber for the mill construction section.

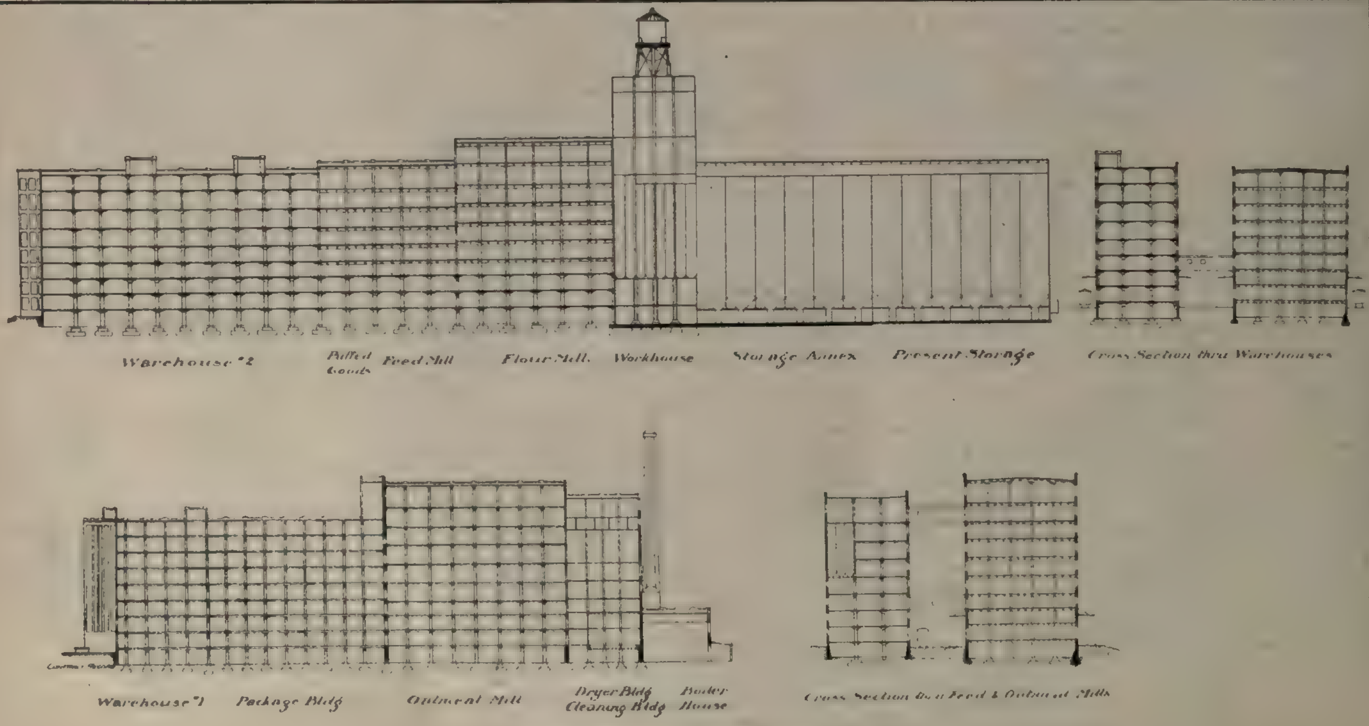
The concrete material supply was very limited, and it was necessary for the contractors to rent two gravel pits and operate them themselves. They hauled by four motor trucks from one pit a distance of two miles and from another pit, by team, a distance of about one mile.

All of the gravel was passed through a crusher and held in storage bins over the mixer at the main plant in which the bulk of the concrete was mixed.

Clearing Site.

The wrecking and clearing up of the site started in June and required two months' time on the east group of buildings and five months in the west group.

Warehouse No. 2 is eight stories and basement. It is of reinforced concrete and the flat-slab system of



Longitudinal and cross sections through plant.

construction is used. The various storey heights are: basement, 11 ft. 0 in.; first to fourth, 12 ft. 0 in.; fifth to seventh, 14 ft. 0 in.; eighth, 12 ft. 0 in. All floors are designed for a live load of 250 lbs. per square foot.

The corn flakes and puffed goods building is of reinforced concrete and is eight storeys and basement high. The first, second and third floors are of flat slab construction, all other floors being of beam and girder construction. The various storey heights are: basement, 11 ft. 0 in.; first, second, third and fourth, 12 ft. 0 in.; fifth, sixth and seventh, 14 ft. 0 in.; eighth, 16 ft. 0 in. Floor loads are: first and second, 250 lbs. per sq. ft.; third, 200 lbs.; fourth to seventh, 175 lbs.; and eighth, 150 lbs.

Warehouses Nos. 1 and 2

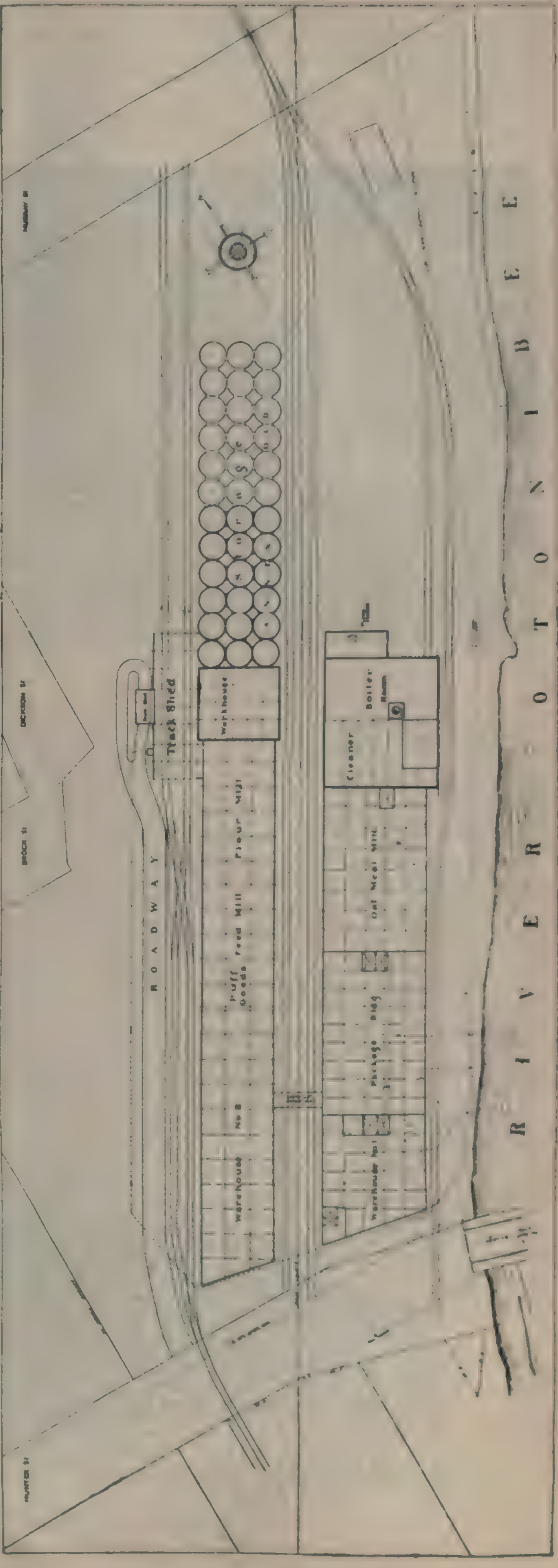
The feed mill is of reinforced concrete and is of the same type and designed for the same floor loads as the puffed goods building.

The flour mill is of reinforced concrete and is nine storeys and basement. The first, second and third floors are flat slab type of construction, and the other floors are of the beam and girder type. The height of the various storeys are: basement, 11 ft. 0 in.; first to third, 12 ft. 0 in.; fourth to seventh, 14 ft. 0 in.; eighth, 16 ft. 0 in.; ninth, 13 ft. 4 in. The first and second floors are designed for a live load of 250 lbs. per sq. ft.; third, 200 lbs.; fourth to eighth, 175 lbs.; ninth, 150 lbs.

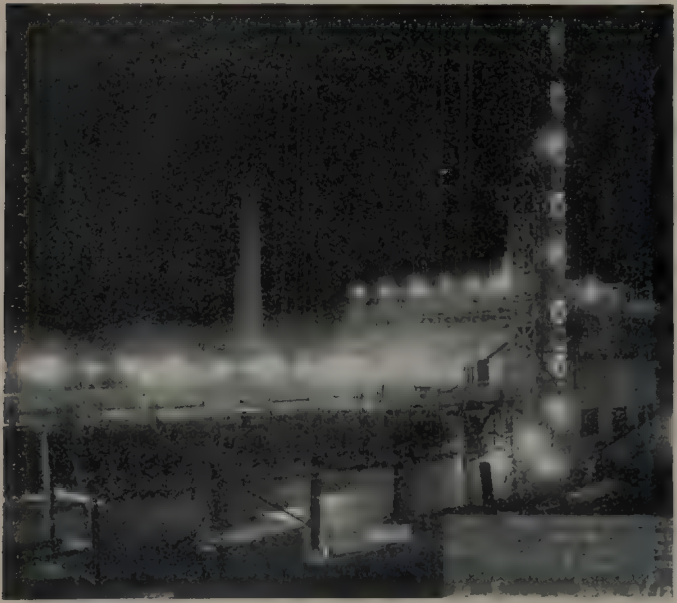
The workhouse is five storeys and basement in height. The basement is 13 ft. 6 in.; first floor, 20 ft. 0 in.; second or bin floor, 75 ft 0 in.; third—also bin floor, 29 ft. 6 in.; the fourth or scale floor, 31 ft. 0 in.; fifth, 11 ft. 0 in. The first floor is designed for a live load of 200 lbs. per sq. ft. and all of the other floors for a load of 100 lbs.

Warehouse number 1 and the package building are of mill construction, the joists running north and south on top of the girders. It is eight storeys and basement. The basement is 13 ft.; the first to seventh floors, 12 ft.; and the eighth is 11 ft. 6 in. The first floor is designed for a live load of 180 lbs. per sq. ft.; all the other floors for 120 lbs.

The oat meal mill and cleaning house is of mill construction, the joists running north and south in



stirrups. It is nine storeys and basement. The basement is 13 ft. 0 in.; first floor, 12 ft. 0 in.; second floor, 11 ft. 9 in.; third, 19 ft. 3 in.; fourth to seventh, 14 ft. 0 in.; eighth floor—oat meal section, 14 ft. 0 in.; cleaner section, 20 ft. 6 in.; ninth floor—oat meal section, 16 ft. 6 in. The first and second floors are designed for a live load of 180 lbs. per sq. ft.; all of the other floors for a load of 120 lbs. per sq. ft.



Lighting for night work.

The first, second and third floors of the dryer building are of reinforced concrete. The other floors are of concrete and structural steel. It is nine storeys and basement in height. The basement is 13 ft. 0 in.; first floor, 12 ft. 0 in.; second floor, 11 ft. 9 in.; third, 10 ft. 3 in.; fourth, fifth and sixth, 14 ft. 0 in.; seventh, 11 ft. 0 in.; eighth, 9 ft. 0 in.; ninth, 14 ft. 6 in.

Fire Protection.

A sprinkler system is installed throughout the plant and pressure is secured by means of a pressure tank carried on a structural steel tower on top of the workhouse. Fire pumps are also installed and constant high pressure is assured throughout the system.

The important feature of fire prevention and protection has been given most careful consideration. All door openings are protected by fire doors and where sliding or swing doors cannot be used, rolling steel doors with a fusible link have been installed.

Steel sash has been used throughout and ample ventilation has been provided varying from 40 per cent. to 100 per cent. ventilation.

The shipping and elevator door jambs are protected with angle iron corners and the sills are formed of checkered steel plates grouted into the concrete sill.

The shipping doors are covered by canopies of structural steel with a reinforced-concrete roof slab.

Grain storage tanks—old and new.

The stairs and elevators have been installed in fireproof stair and elevator towers, all entrances of which are protected with fire doors of the most modern type. A stand pipe and industrial fire hose are also provided.

Ample lavatory accommodation has been provided and provision has been made for any possible future extensions. All interior partitions are of 4 in. hollow tile.

The stairs are of iron, reinforced concrete and wood, with hand rails of gas pipe.

The roofing is of felt pitch and gravel. The roofing

General view of plant from River—Quaker Oats Co., Peterboro, Ont.

is turned up into the parapet and secured in place with cement grout. The flashing is all of jumbo weight. The roof is well drained to extra heavy, well-protected roof hoppers. All roof drainage is inside.

Grain Storage Tanks

The grain storage tanks are constructed of reinforced concrete. Reference to the block plan will show that the old tanks have been retained. These were practically uninjured by the fire and were easilly repaired. The new tanks were erected, as shown in the plan, in continuation of the line of existing tanks.

The east and west groups of buildings are connected by means of several bridges and tunnels.

The power plant consists of three, 200 h.p., Allis-Chalmers, water-tube boilers, and a 75 h.p. Sterling boiler. The boiler house equipment is most modern in every respect.

Both Grand Trunk Railway and Canadian Pacific Railway sidings furnish the plant with excellent shipping facilities.

All of the buildings were completed between August and December, 1917, except warehouse No. 2, which was constructed in 1918. The total cost of the structural work, exclusive of any machinery or manufacturing equipment, amounted to $1,500,000.

The new plant was designed by, and the construction work carried out by, the Canadian Leonard Construction Co., Limited, contractors and engineers, of New York, Chicago and Peterboro, Ont.

Resilient Chairs and Reinforced Concrete Ties for Railway Track

THE latest type of concrete sleeper brought to notice has the promise of being a success, and deserves to be, considering the careful mathematical investigation made of the various stresses it is subjected to when designing it. Mr. Louis Green, of the East Indian Ry., has been working at it in collaboration with Mr. R. St. George Moore, of Westminster, since 1912, and it has recently been tried out on the East Indian Ry. With a knowledge of the inherent defects found in concrete sleepers previously designed, they set themselves to solve four main difficulties in the problem, viz.: (1) to obtain resilience, if possible, equal to that of the wooden sleeper and cast-iron chair combination; (2) improve the connection between the chair and the ferro-concrete block; (3) scientifically arrange the reinforcement to meet the strains due to variations in the packing of the road; (4) increase facilities for handling. The illustrations, Figs. 1 and 2, show a chair and sleeper in combination with a bull-headed rail. The chair is made of wrought steel plate forming a suspension loop; it is 4 in. wide and ½ in. thick; there is a tendency for the jaw to close slightly when the chair is depressesd, but it springs back immediately the pressure is removed. The feet of the chair enter into direct combination with the reinforcement, thus allowing of the resolution of the forces in the chair directly into the lines of reinforcement provided for each specific strain. The distribution of the stresses in the reinforcement is determined largely by the packing of the sleeper, and as consideration has to be given defective packing it results that the total amount of reinforcement is considerably more than would be needed for a perfectly packed sleeper. Obviously, when a sleeper of this kind is uniformly packed under a rail there is very little tensile strain on its top reinforcement, when it is properly packed in its center and loosely packed at its ends there is considerable tensile strain at top, and when it is properly packed at its ends and loosely packed at its center there is a compressive instead of a tensile strain at top, and at bottom a tensile instead of compressive strain. The bending moment therefore is much greater in either of the two latter cases than when the sleeper bears uniformly on the ballast. The reinforcement has for this reason been designed to resist the maximum combined stresses which would be caused by the standard wheel-load when the sleeper is bearing unevenly on the ballast. On Figs. 1 and 2 the lower tension members are marked e, e, e. The upper tension members are marked f, f, f. The direction tensions from the chair are taken by n and g. The tension caused by the transverse bending moments are taken by b, b, b. To these must be added the top and bottom members of the side frames d, d, d. As will be seen from the illustrations the sleepers are in two halves connected by a tie rod which is attached to the chair by ordinary gibs and cotters.

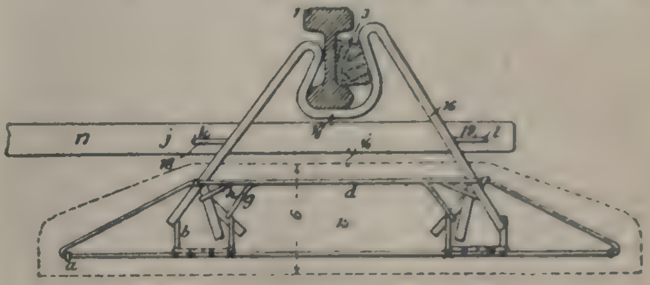


Fig. 1.

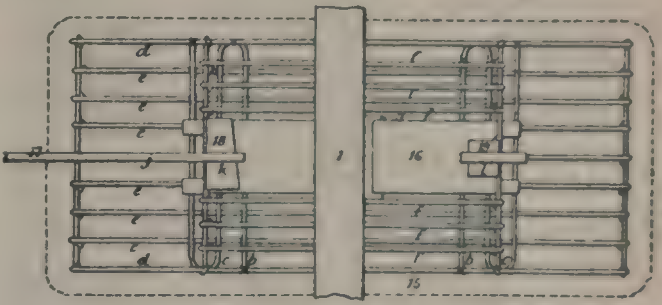


Fig. 2.

In the first designed pattern the chairs were made 6 in. wide of 3/8-in. plate; these were tried on the Shalimar Branch, where 11 sleepers were laid on Jan. 25, 1914. They have stood very well and have even come out of a derailment with only trifling injury when it is believed the D. O. sleepers with which the Shalimar line is laid would have been much more seriously damaged and would have caused obstructions to traffic. Soon after the same type of chairs and sleepers were tried in Howrah freight yard and broke up badly; on examination it was concluded that the wires could not safely take the tensile strains imposed by the bending moments and horizontal components of the load, there were besides bad joints in the reinforcement and bad spacing of upper and lower members. After these failures a further investigation was made of the stresses in the sleepers and the design somewhat modified. On Nov. 24, 1914, and Jan. 20, 1915, 70 of the improved type were laid on the third line between Konnagar and Rishra stations, where the speed limit of passenger trains is 30 miles. They kept well and the road was reported to be easy running and easily maintained. In May, 1915, they were moved into the main line, where the speed of trains sometimes reaches 60 miles an hour.

The Government Inspector, reporting on them in 1917, said: "The reinforced concrete sleepers referred to in paragraph 5 of last year's report were examined and found to have stood another year's traffic very well. These sleepers were said to cost only Rs. 6-8 for flat-footed rails and Rs 7-8 for double-headed rails, including fastenings. A vibrating table has been received for making these sleepers. When the first cost and probable life are taken into account it looks as if these sleepers would drive wooded and metal sleepers out of the market." Up to the present, of course, there are no data available for estimating the life of these sleepers, but it is believed they will last from 20 to 30 years. On this basis a comparison is made as follows of the cost per mile per annum of certain kinds of sleepers:

(a) Wooden sleepers at 7s each, with cast iron chairs 3.11 square ft. bearing area and 12 years' life, cost per annum	£127.30
(b) Wooden sleepers at 5s each, with cast iron chairs 3.11 square ft. bearing area and 12 years' life, cost per annum	100.99
(c) Cast iron pedestal sleepers, with wrought iron tie-bars 2.75 sq. ft. bearing area and 30 years' life, cost per annum	109.50
(d) Ferro-concrete sleepers with wrought-iron chairs and tie-bars, 3.9 sq. ft. bearing area and 20 years' life, cost per annum	97.07
(e) Ferro-concrete sleepers with wrought-iron chairs and tie-bars, 3.9 sq. ft. bearing area and 30 years' life, cost per annum	79.80

Chairs for flat-footed rails have little resilience by virtue of their shape, but this difficulty has been overcome effectively, as proved by the trials, by making the table of the chair longer than the width of flange of the rail. The attachments consists of a bolt with a square nut and a spring washer, the nut is made to lie close against the tie-rod and therefore cannot turn. The spring washer provides the necessary elasticity in the attachment. Where it is desired to insulate one rail from the other for the purpose of using the rails as conductors for electric currents for signalling purposes, special tie-rods with a central insulating device can easily be substituted in the case of either bull-headed or flat-footed rails. The inventors have patented the sleepers and chairs here described.

The Setting Process in Lime Mortars and Portland Cements[*]

By Cecil H. Desch

THE hardening of a simple lime mortar, composed only of slacked lime and sand with water, is a mere process of desiccation. The calcium hydroxide forms an apparently structureless mass, which may be either colloidal or minutely crystalline, and the cohesion of this mass furnished the necessary strength. The sand merely prevents the cracking which would otherwise take place during the contraction on drying, by sub-dividing the lime into thin layers. As time goes on the calcium hydroxide may recrystallize to a certain extent while those portions of the mass which come into contact with the atmosphere may be converted into the crystalline carbonate, but neither of these changes is essential to the hardening of the cement. There is no chemical reaction between the lime and the sand. On the other hand, when pozzolanic substances are added to the mortar, such as the volcanic earths of the Mediterranean which were used by the Greeks and the Romans, the trass and ground tiles which were employed by the Romans in the more northern regions, or the burnt brick and ballast added to this day in India, a chemical reaction takes place between the lime and the active or soluable silica which is the essential constituent of all pozzolanic materials, and calcium metasilicate is formed.

Portland cement is a more complex material. The constitution of the clinker has been established by the brilliant investigations of the Geophysical Laboratory staff, at Washington. The compounds which are or may be present are tricalcium silicate, $3CaO,SiO_3$; calcium orthosilicate, $2CaO,SiO_2$; tricalcium aluminate, $3CaO,Al_2O_3$; pentacalcium tiraluminate, $5CoO,3Al_2O_3$; and free lime, CaO. Campbell has recently given reasons for believing that tricalcium aluminate is rather to be regarded as a solid solution of lime in the pentacalcium trialuminate, but this does not materially affect the present problem. Not more than three of the above-mentioned compounds can be simultaneously present in the clinker in a state of equilibrium, but since the components do not reach the temperature of fusion during the process of manufacture, it is actually possible for small quantities of one or more additional constituents to occur in commercial clinker. It does not appear, however, that clinker made in a rotary mill departs very widely from the state of equilibrium.

An examination of the ternary equilibrium diagram shows that the clinker will contain a ternary eutectic, there being two such eutectics within the usual range of the composition of clinker. The microscopical examination of transparent sections of clinker does not reveal the presence of any eutectic, but this is simply due to the minuteness of the structure, much overlapping occurring even within the thickness of a thin section. When, however, the specimen is polished on one surface only and lightly etched, as in the examination of metals, the eutectic structure is clearly revealed. The writer has published one such photograph, and Mr. T. Hattori, working in the writer's laboratory, has since obtained very beautiful eutectic structure of Japanese clinker. The calcium aluminate which is chiefly present as a constituent of this eutectic is consequently in a finely divided form, and therefore in a condition to react readily with water.

According to the explanation of the setting process put forward by Le Chatelier, in 1887, the ground cement reacts with water in such a way that the silicates and aluminates are hydrolysed, the staple compounds being the hydrated metasilicate, $CaSiO_3\ 2.5H_2O$, and a hydrated tetracalcium aluminate, $4CaO,Al_2O_3,12H_2O$, the excess of lime liberated by the hydrolysis forming calcium hydroxide. Microscopical examination of the reactions of the constituents with water led to the conclusion that the process was strictly analogous with that of the setting of plaster, an unstable supersaturated solution of the basic silicate, for example, being formed initially, followed by rapid crystallization of the stable phase in the form of radiating needles. In reference to this it should be remarked that the process is largely dependent on the ratio between solid and water, and that in hydration experiments on a microscope slide the quantity of water used is relatively much larger than in the gauging of cement in practice, and that this fact probably accounts for certain discrepancies recorded by different observers.

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[*] Before the Faraday Society.

The alternative hypothesis was proposed by W. Michaelis, in 1893, and expanded in a later paper. On this view, while the chemical reactions assumed are those which were shown to take place by Le Chatelier, the physical conditions are supposed to be different The hydrated metasilicate is considered to form, not a mass of radiating crystals, but a gelatinous mass or gel, the gradual dehydration of which brings about the hardening of the cement with time. The aluminate crystallizes much more readily than the silicate; but even this is regarded as forming a gel when the solution is sufficiently supersaturated—that is, when the quantity of water is small, as in the case in the practical utilization of cement.

The presence of gelatinous material at an early stage of the setting process is readily observed. It has been photographed by Stern, and the increase of size of the cement particles by absorption of water and consequent swelling of the gelatinous sheath which forms around them has been described by Ambronn, and may be readily confirmed. According to Colony, a reaction subsequently takes place between this early gelatinous material and the remaining constituents of the cement, and a secondary amorphous product is formed, the desiccation of which is the cause of the hardening. At a later stage crystals of calcium hydroxide calcite, and zeolites make their appearance.

An attempt to distinguish between the various possible colloidal products has been made by Keisermann, using the method of staining with organic dyes. The results indicate that the gelatinous sheath consits of calcium metasilicates, which compound also occurs in the form of small needles, while the calcine hydroxide and aluminate assume the crystalline form. These staining results with colloids depend largely on the concentrations of the substances concerned, and the writer, possibly not workiing under precisely similar conditions, has not succeeded in confirming all of Keisermann's results. The dependence of the observations of the size of grain has been pointed out by Wetzel. Other experiments in which stains were used led Blumenthal to the conclusion that the metasilicate and aluminate were first formed in a crystalline condition, so that the cement sat like plaster, but that a colloidal gelatinous silicate was subsequently formed, and strengthened the mass by binding the crystals together and filling the pores.

The process of setting of the individual constituents, as well as of commercial clinker and artificial mixtures, has been examined in great detail in the laboratories of the U. S. Bureau of Standards. The staining method has been applied as a means of identification, and the hydration has been followed under various conditions of temperature and proportion of water. The general conclusion is that the initial set is due to the hydration of the aluminates, and that the only stable hydrated aluminate is the tricalcium salt, the water content of which is variable. Either the 5.3 compound or monocalcium aluminate, if present, undergoes hydrolysis, and the tricalcium salt is formed together with free alumina, the latter separating in a colloidal hydrate form. In presence of an excess of water the product may be crystalline, as in Le Chatelier's original experiments, but with a restricted supply of water an impervious layer of the amorphous material may be formed, retarding the further action of water. The silicates are hydrated much more slowly, the products being calcium hydroxide and an amorphous jelly of hydrated silicate. The hydroxide may be crystalline or amorphous, according to the concentration and to the rate of hydration. The hydrolysis of the silicates is even considered to proceed so far that gelatinous silica is liberated. The subsequent conversion of a part of the gelatinous mass into crystals is considered to result rather in a loss than in a gain of strength.

It would appear that conclusions based on the examination of mixtures of ground material with water on a miscroscope slide must be applied indiscriminately to the conditions of actual practice. The ratio of water to salts is of the utmost importance in determining the nature of the products, although the chemical reactions may be the same in both cases. An attempt has been made by Von Weimarn to show that the passage from the collodial to the crystalline condition is a continuous one, and that the difference consists only in a difference of size of the particles. This may be accepted in the sense of considering collodial materials as being in such a fine state of division that the surface forces are comparable in their effect with those which depend on mass. It is then not difficult to understand that the degree of supersaturation of the solution may determine whether the product which separates shall have a definite crystalline form or shall be in the ordinary sense amorphous. The real nature of the colloidal condition has been unnecessarily obscured by the barbarous terminology which has been adopted by so many writers on the chemistry of colloids, and especially by the school of W. Ostwald.

A final reference should be made to the action to catalysts on the process of setting. The subect has not been sufficiently investigated, and affords a promising field for research.

A reorganization plan is proposed by the bondholders' representatives on the directorate of the National Brick Co. of Laprairie, Ltd. The idea is to form a new company to be called the Laprairie & Delson Brick Co. Ltd., or some other suitable name. Up to Feb. 28 last the deferred interest on bonds totalled $450,936. Under the reorganization, the bonds outstanding would be exchanged into a new issue, the scrip given against deferred interest would be funded into preferred stock, and the present holders of the common stock would receive one share of new stock for every four shares of old. In consideration of the concessions asked from the bondholders, the latter are to be given one share of stock for every $300 par value of their bonds, scrip and accrued interest.

The Dominion Bridge Company, Limited, Montreal, has received an order for two, 5 motor, 40 ton capacity, 60 foot span, electric travelling cranes from the British American Nickel Corporation, Limited, at Sudbury, Ontario.

National Laboratory for Industrial Research

By Sir Richard T. Glazebrook*

THE idea of a laboratory devoted to industrial research is by no means novel, and the steps by which ordinarily a scientific discovery develops into a manufacturing process are generally recognized. First and foremost we have the research student impelled by his thirst for knowledge, his desire to penetrate ever deeper into the mysteries of nature; he does not work with the deliberate intention of making something of service to humanity. Faraday's discoveries of electromagnetic laws were at first as useless as the new born babe, but had within them that power and potency which has transformed the industry of the world. Rontgen, when he discovered X-rays, or J. J. Thomson when he tracked down ions and corpuscles thought little of their application to surgery and the countless benefits they have brought to suffering humanity.

There must be institutions where research work is carried on for its own sake, where men may make discoveries which may revolutionize and not merely reform the world, where they may train students in those fundamental laws and principles which must be at the root of every successful endeavor to apply science to industry. But there is a wide gap between such homes of science and the works of the manufacturer, and it is to fill this that laboratories of industrial research are needed.

Abbe realized in 1876 that British optical instruments had reached the highest development possible until a radical change was made in the properties of the glass used for lenses; it took years of patient labor, aided by subsidies from the Bavarian Government, before he and Schott were able to place Jena glasses on the market. Von Bayer discovered synthetic indigo about 1880, but it was not until 20 years had passed that the Badische-Anilin-Soda-Fabrik produced it on a commercial scale. Long and patient inquiry was needed in the great laboratory of the General Electric Co., of America, at Schenectady, before the Coolidge tube was developed from the original X-ray tube. The work of the discoverer needs development and extension before it can be utilized by industry. This is the task of the Laboratory of Industrial Research.

Or, again, looking at our problem from the opposite side, a manufacturer has some question to solve—the utilization of a waste product which if it were not waste would make all the difference between commercial failure or success, the discovery of a material with some special properties—e.g., a light alloy of great strength at a high temperature—needed before a new machine can be completed. Such a man must have access to a laboratory fitted and equipped for the purpose with a trained staff having stored experience as the result of previous work or researches on cognate questions.

The Need of Special Laboratories for Research Work.

But it is sometimes urged: "Why do you need a special laboratory for such work? Can it not be done equally well in one of the university or technical college laboratories? It is not enough to multiply and organize these, to bring the teachers into direct contact with the manufacturers of their districts, and to encourage the students at an early stage to interest themselves in the scientific problems they will have to solve later in their daily work?" To this my answer would be that it is not enough. The primary work of the professor is to teach and to advance knowledge, that of the student is to learn how to research and to apply his knowledge. The professor, will, no doubt, keep in close contact with the industry and take his illustrations from the manufacturers of his district, but before his students can usefully engage in industrial research they must have a thorough grasp of the principles underlying all research and of the methods of employing them. Industrial problems are usually too complex for students, and, moreover, the answers are wanted too rapidly to make them subjects of a student's exercise; he will learn by failures; by the inexperienced the right road is only found at last after many tempting tracks leading nowhere have been vainly tried. The manufacturer who comes with a problem which cannot wait will be more sure to find a solution if he applies to men whose daily work it is to attempt such problems and who have the experience of the past to guide them. Moreover, the plant and equipment required is special; the industrial research laboratory must be fitted on the industrial scale. A rolling mill is not an adjunct required in every technical school where the principles of metallurgy are taught, and yet without a rolling mill the study of the light alloys at the National Physical Laboratory could not have been brought to the pitch it has been. The plant and equipment of an industrial research laboratory are provided for the purpose of applying science to industry. The requirements of students and the educational value of the apparatus need not be studied. There must, of course, be many specialized laboratories of industrial research; much more than the National Physical Laboratory is required.

And now, turning to the future, let us consider what is to be the position of the institution as a Central Laboratory of Industrial Research. In a lecture delivered in Birmingham, rather more than a year ago, shortly after Lord Crewe had announced the formation of the Department of Scientific and Industrial Research, I referred to such laboratories and I wrote:

There must be more than one; in many cases an industry can be best served by a laboratory near its principal center. Large firms, again, may each prefer to have their own trade secrets—this must be so to some extent—and trade jealousies may interfere with full co-operation, but a private laboratory on a really sufficient scale is expensive; too often it becomes little more than what I have called a works laboratory for testing the products of the factory, and for the smaller firms, at least, the only way to secure the full advantage of scientific advance, is by co-operation—co-operation in the laboratory, co-operation, with specialization in production, in the works themselves.

It has been suggested that I wish to make the National Physical Laboratory not merely a national, but the only bridge between science and industry. This is not the case; let me quote, in order that I may amplify them, the concluding words of the lecture:

"Associations are to be formed representing various trades or industries; the representatives of these will discuss with representatives of the Advisory Committee, and other experts, questions needing scientific investigation and, when these are determined, the grant, supplemented in most cases by funds raised privately or contributed by the industry, is to be used to carry them out. Such work needs laboratories, and it is here, it seems to me, that the future of the National Physical Laboratory lies.

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*From a lecture delivered at the Royal Institution.

"In many cases, no doubt, the researches contemplated must go on in special laboratories, arranged and equipped for the purpose—laboratories closely connected with the industry it is desired to help, situated at the great manufacturing centers; but there are many other researches of wide interest and great importance for which a central laboratory is the proper house, a laboratory fitted and equipped in an ample manner, with a trained and competent staff.

The body controlling industrial science research must have access to a laboratory in which may be studied the many problems which do not require for their elucidation appliances of the more specialized 'works' character, or opportunities only to be found in particular localities; where a staff is available, able and experienced, ready to attack under the advice of men skilled in industry, the technical difficulties met in applying new discoveries on a manufacturing scale, or to develop ideas which promise future success.

"Such a role the National Physical Laboratory should be prepared to play, such is the future which I trust may be in store for it."

This work has already been begun. The various trades associations have been formed, or are being formed, for the promotion of research on matters of interest to the members of the trade.

Research for Trade Associations.

The principal objects of an associaion, as they would be laid down in the memorandum of association, may be briefly summarized thus:

(a) To promote research in connection with the manufacture and use of . . . . . by maintaining or subsidizing existing laboratories and workshops, or, if necessary, establishing and equipping laboratories and workshops.

(b) To retain or employ skilled professional or technical advisers in connection with the objects of the association.

(c) To encourage the discovery of, and investigate the merits of, improvements which may seem capable of being utilized for the purpose of the respective industry, and to take out patents or licenses relating to such inventions or improvements and to perfect and develop them.

(d) To support or to establish libraries, collections, or museums necessary for the promotion of the industries concerned.

(e) To publish or to assist in publishing any literature, statistics, or information relating to the subject of . . . . . . that may be of value to members of the association.

(f) To promote in any way desirable the education of those engaged or likely to be engaged in the industries concerned.

(g) To co-operate with other associations or bodies having objects bearing on the work of the association.

(h) To apply to the Government for, and to accept, grants of money and other assistance for the purpose of the objects of the association and to discuss and negotiate with the Department of Scientific and Industrial Research and other Government department's schemes of research and other matters within the objects of the association.

Each such association will probably require its own laboratory situated, for preference, at the center of the trade concerned. This will deal with the special problems of the trade, problems which need intimate association with works conditions for their solution and for which the close supervision of men in works is important.

Industrial Problems That Can Best Be Dealt With in Central Laboratory.

But there are numerous industrial problems which can best be dealt with in a central laboratory: let me give some instances of what I mean. Such, for example, are:

(1) Investigations into methods of standardization or of measurement generally.

(2) Investigations into the physical and mechanical properties of materials used in many trades.

(3) Investigations useful to a trade which has no fixed center, but is widespread over a country.

Or, again, (4) a central laboratory will be of service as a means whereby information as to large questions of general interest, investigated either at the central laboratory itself or at the local special laboratories, may be circulated and time saved by placing at the disposal of any special laboratory requiring them the results obtained elsewhere.

Instances of Investigations Useful to a Trade Which Has No Fixed Center.

A research has been in progress for some time at the laboratory into the heating of buried cables carrying electric currents. In connection with the wiring rules committee of the Institution of Electrical Engineers much has been done to determine the temperature to which the cables used in house wiring are raised in various circumstances, and to fix the safer currents to be used in each case. Our knowledge of the temperature reached in cables when buried in the ground is very scanty and somewhat conflicting; much depends on the nature of the covering used to protect them, and possibly something on the nature of the soil. Cables laid in ducts again differ from those protected merely by the ordinary forms of lead or other covering, and yet the life of the insulation depends in great measure on the temperature reached when the current is flowing and thus regulates the carrying capacity of the cable. Thanks to the co-operation of supply authorities in many parts of the country much valuable information has been collected, and, though the research at the laboratory proceeds but slowly, results of great importance are being obtained. Such a research needs large appliances, and currents up to 8,000 amperes or 10,000 amperes will be employed. It needs also the resources of a fully-equipped physical laboratory in order to measure accurately the temperature differences due to varying conditions; when complete it will be of value to all supply companies. This is true of many other electrical tests and experiments; the results are of wide application; it is desirable that they should be widely published.

The building trade offers another example of the kind. Brick and stone, wood and iron, have been used for long, and their properties when employed for building construction are generally well known. This is less true of other more modern materials—ferro-concrete, for example. There are rules—based no doubt on the best experience available—for estimating the strength of beams, columns and floors, but there is much scope for injury. Accordingly, at the instance of Sir John Cowan, of the firm of Messrs. Redpath, Brown & Co., who is bearing the expense, apparatus is being built to test columns up to 15 ft. or 20 ft. in length and floors of considerable size. War conditions again are interfering, but the work is progressing slowly and must be done. There are other materials besides ferro-concrete urgently calling for examination. Nor is the strength of the materials the only factor to be considered. Materials transmit heat in very varying amounts and the comfort of a house, to say nothing of the cost of living in it, will depend on whether it is possible easily to keep it warm in winter, cool in summer. Recently we were asked to compare the heat losses from two enclosures exactly alike in all respects, except that one was roofed with corrugated iron, the other with some preparation of asbestos. It was found that the latter cooled 20 per cent. faster than the former; the loss of heat depends, in part, on the conductivity of the material, in part on the emissivity of its surface, and the superior emissivity of the asbestos sheet more than made up for its inferior conductivity. In this connection it is clear there is much to be done, and for such work a central laboratory, with proper equipment, is the most suitable place. Arrangements are in progress by which it is hoped many of these questions will be thoroughly investigated.

The importance of the collection and dissemination of information on matters connecting industry and science is clear. At a central laboratory much of the information will be to hand; the accumulated experience of the staff, their knowledge of the work done in the sectional laboratories, their appreciation of the bearing on industry of inquiries in the region of pure science, are all valuable assets and a proper organization only is needed—by means of a bulletin or in some such way—to circulate their information where it is most wanted.

There is ample room for a central laboratory without trenching in the least on the spheres of the local sectional institutions. If the Department of Scientific and Industrial Research is to carry out effectively the work it contemplates such a laboratory is essential, and my hope is that the National Physical Laboratory may develop into such an instution in colse connection, through the department, with local laboratories throughout the country.

Four Years' Operating Results of Minneapolis Water Purification Plant

DATA covering the first four years' operation of the purification plant of the city of Minneapolis, are given by Mr. F. W. Cappelen, city engineer, in the Transactions of the American Society of Municipal Improvements. The plant was put in operation Jan. 10, 1913. It consisted of 12 filter beds, each of 4,000,000-gal. maximum capacity, with two coagulation chambers, each of 1,300,000-gal. capacity. During the year it was found that the coagulation basins were not large enough, and also that the filter capacity had to be increased. This work was completed, in 1915, by adding four filters, each of 4,000,000 gal. maximum capacity, and two coagulation basins, each of 1,500,000 gal. capacity. In 1917 construction was started on eight filters, giving a total of 96,000,000 gal. which will be in operation this fall.

Filtration Data.

The greatest total amount of water filtered during any one year was in 1916, with a total of 10,719,959,000 gal., an increase of 1,344,278,000 gal. over 1915. The average daily amount of water filtered during 1916 was 29,289,500 gal., an increase of 3,602,500 gal. per day over the 1915 average. The maximum amount of water filtered during any one month was in July, 1916, with 1,203,628,000 gal. and the maximum amount filtered during a 24-hour day was 58,929,000 gal.

The average number of filters in service during 1916 was 15, as compared with 13 in 1915. The rate of filtration was reduced to an average of 2,100,000 gal. per acre of sand surface per day. This would be 64 per cent. of the normal rate of filtration for which the filters were constructed, 125,000,000 gal. per acre per day. The additional filters in service during 1916 also caused an increase of 20 per cent. in the length of filter runs and a decrease of 10 per cent. in the amount of wash water used for 1915.

The amount of alum used in 1916, while greater in total amount because of the greater amount of water filtered, was 3.4 per cent. less than the amount used in 1915, if we consider the number of grains of alum per gallon of water treated. The cost of alum per 1,000,000 gal. of water for each of the four years was as follows: 1913, $4.66; 1914, $4.11; 1915, $3.47, and 1916, $4.25. The increased cost for alum in 1916 was due to the war, the price of alum having advanced approximately 37 per cent. A large stock of alum carried over from 1915 helped to keep down the alum cost for 1916.

Hypochlorite of lime had been used for sterilization from the time the filtration plant was put in operation until Dec. 6, 1915. At that time it was replaced by liquid chlorine, due to the scarcity and high price of hypochlorite.

The cost for sterilization in 1916 was $0.27 per 1,000,000 gal., as compared with $0.21 in 1915. If hypochlorite had been used in 1916 the cost would have been fully 1,000 per cent. greater for sterilization, the price of hypochlorite having advanced from $0.015 to $0.20 maximum per pound in 1916. A stock of 5,640 lb. of hypochlorite of lime which was left over when the liquid chlorine treatment begun was sold by the purchasing department at an average price of $0.112 per pound, a net gain to the city of approximately $0.09 per pound.

There have been no complaints of odors or tastes in the filtered water due to the sterilizing agent since the liquid chlorine treatment was installed. The Wallace & Tiernan chlorine machines have given very satisfactory service.

The total cost per 1,000,000 gal. for purification of the water was $9.18 in 1913; $9.40 in 1914; $8.38 in 1915, and $8.90 in 1916. The cost for 1916 shows an increase of 6.2 per cent. over that for 1915, the chief increase in unit costs being for coagulant and sterilizing agent, which advanced in price in 1916. There were decreases in the year from a maximum of 224 parts per million to a minimum of 80 parts.

The average total hardness also has remained practically the same. It varies from 248 parts per million to 82 parts during the year and averaged 165 parts per million for 1916.

Free carbonic acid in the filtered water showed an average of 10 parts per million in 1916 as compared with 12 parts in 1915 and 18 parts in 1914 and 1913.

Typhoid Fever Statistics.

Table I. contains typhoid fever statistics for Minneapolis for the years 1900 to 1916. It is interesting to note that the typhoid death rate has remained practically the same since 1911, the year following the installation of the hypochlorite of lime treatment of the city water supply, until the year 1915, when it dropped to 7 per 100,000. In 1916 there was a further drop in the typhoid death rate to 4.7 per 100,000.

Table I.—Typhoid Fever Statistics.

	Number of typhoid cases	Number of typhoid deaths	Death rate per 100,000 pop.	Remarks
1900	376	79	38	
1901	630	121	58	
1902	320	66	29	
1903	720	95	39	
1904	738	103	41	
1905	269	62	23	
1906	252	97	34	
1907	181	77	26	
1908	104	51	17	
1909	95	59	19	
1910	1252	173	57	Chlorination begun Feb., '10
1911	200	36	11	
1912	186	37	11	
1913	136	41	12	Filter plant in operation Jan. 10, '13
1914	278	38	12	Pop. 343,460
1915	166	25	7	Pop. 353,460
1916	181	21	58	Pop. 363,460

An Introduction to the Philosophy of Sewage Irrigation

By James Craig*

THE application to land of liquid sewage in a sufficiently mobile condition to gravitate is commonly known as sewage irrigation and from the time of the introduction of sewers for conveying the sewage away from populated areas down to almost the close of the last century irrigation of land was the system of disposal chiefly in vogue. But as our cities and towns cannot all comply with the idea of the worthy countryman who, after his first visit to London, being asked what he thought of it, replied "That it was a fine place if it was out in the country," it is obvious that other considerations attract these congregations of the people, and the question of whether suitable land can be obtained for sewage irrigation comes as an afterthought and often debars the acquisition of sufficient or suitable land for sewage irrigation.

It is regrettable that many of the old sewage irrigation farms caused serious disappointment, and the regret has been emphasized greatly since the country has been at war and fertilizers have become almost unobtainable. The matter is further aggravated by the fact that in many cases the old sewage farm was loked at through financial spectacles rather than from a sanitary point of view, and the gulf was so great between the status of the man in charge and other officials with probably not more responsibility that failure was the natural corollary.

Choice of Site.

In choosing a site for sewage irrigation the nature of the surface and subsoil is of great importance. An ideal formation would be a gravelly loam overlaying a coarse, gravelly subsoil; indeed, unless a sufficient area with means for extension of something approaching this type of land can be secured within reasonable distance of and altitude to the town and stream, other methods should be considered. Any land having impervious strata or clay formations within 3 ft. 6 in. of the surface should be completely avoided for irrigation purposes.

As regards the contour, the near the site can resemble a slightly inclined plane the better; but while an undulating surface is more costly to lay out and requires greater cost and skill to irrigate, the general principle of avoiding the path of least resistance in actually applying the sewage to the land holds good on most treatment areas.

The sewage should be delivered at a point of the irrigation area from which it can diverge by gravitation to the whole area and prospective extension areas. It will be found most convenient to have the system of distribution arranged so that the rate of flow per acre can be varied, enabling large or small sections the area to be irrigated or rested as desired.

The conveying channels may be made of a variety of materials such as wooden or metal troughs, concrete channels, earthen channels, stoneware pipes, concrete tubes, cast-iron pipes, etc. These may be laid above or below ground, but the author considers that glazed stoneware pipes or concrete tubes thoroughly jointed and sufficiently underground to be protected from climatic influences answer the purpose admirably. Of course other carriers than main arteries may be advantageously formed in the soil itself unless a valley has to be crossed, when pipes laid on the syphonage principle would have to be resorted to in preference to carrying the liquor overhead in open or closed channels.

Distribution

The distribution of the sewage on to the land requires careful attention. With arable land the ordinary ridge and furrow method of distribution gives very good results as long as the sewage is allowed a fair velocity for 4 ft. or 5 ft. after entering the furrow. Then the velocity should be checked by means of small stanks made from the soil at distances apart to suit the gradient of the section being irrigated. These baffles can be made by spade or shovel, or an arrangement can be fixed on the ordinary horse hoe to do the work more expeditiously. Five-feet baulks are also suitable for arable land. Grass land and other broadcast-sown crops may be laid out with slight furrows further part, but at distances and altitudes to ensure quick and thorough saturation of the surface. In most grades of irrigation land it will be found beneficial to the production and maintenance of a good effluent to have the underground drains laid parallel in preference to what is known as the "herring-bone" or lateral principle, and in the application of the sewage to the surface it should be conveyed, so far as is practicable in a direction parallel to the underground system of drainage. Crossing over the line of an underground drain with furrows conveying sewage should be avoided, as this often causes percolation of polluted water directly to the drains and the polluting of an otherwise good effluent. Distribution is greatly aided by regular loosening of the surface of the ground; if it is allowed to form a crust, absorption is retarded, the sewage takes the path of least resistance and ponds inthe lower places with often disastrous results as well as aerial and acqueous pollution.

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*Sewage Works Manager, Romford, Essex, before the Association of Managers of Sewage Disposal Works.

For the purpose of laying underground drains for drawing off effluent the author is of opinion that these should be of an average depth of 4 ft. 6 in. with a gradient of at least 1 in 1,000, and glazed socketed stoneware pipe drains laid parallel to each other and discharging into an intercepting drain which should be cement joined with an effluent inspection chamber for each independent section of the land. The individual pipes of the collecting drains should be laid so that the spigot end only enters about half way into the socket—not forced tight up, as is done by many drainers with the back of the spade.

Saving in Fuel

THE Willys-Overland Company, Toronto, had an oil burning system installed with burners on two horizontal return tubular boilers where figures of cost of power have been carefully kept in detail and found exceedingly interesting results. The system was installed to conserve coal last winter, with the results shown in the accompanying table.

Heating surface—3,777,000 cubic feet with coal.

Boilers—horizontal return tubular 60 ins. and 16 ft.

Pressure maintained during winter of 1916 and 1917 using coal—85 to 110 lbs.

Coal consumption, 1916 and 1917—20 tons per day, cost	$200.00
Men employed, 9 laborers and firemen, 35c per hour, 12 hours per day	36.00
Maintenance charges	4.00
Per working day	$240.00

Added heating surface with new buildings, 473,000 ft., making a total of 4,250,000 cubic feet.

Pressure maintained during winter of 1916 and 1917, using oil as fuel—85 to 125 lbs.

1,200 gals. fuel oil per day at 12c per gal.	$144.00
Men employed, 2 firemen at 35c per hour, 12 hours per day	8.00
Maintenance	3.00
	$155.00

Net saving of using oil, $85.00 per day.

Net saving per month, $2,550.

This company also uses oil burners on hardening furnaces. With four burners the consumption was forty gallons per day at 12c per gallon = $4.80.

The system has been in operation nine months, and during that time the oil burners were not cleaned. They ran 504 hours without intermission and only shut down to permit boiler to be cleaned.

The heat is distributed the whole length of the boiler.

Montreal Builders' Exchange

AT the last meeting of the directors of the Montreal Builders' Exchange, Mr. J. P. Anglin, the president, suggested that the organization of the Exchange as prescribed in the Constitution could be improved, and that the By-Laws should be amended so as to fit in more completely with the present altered conditions. Further, in view of the conference of the building industries of Canada to be held in Ottawa this month, and at which among other subjects, the usefulness of various builders' organizations would be discussed, he thought the Exchange should be in a position to suggest and develop a scheme which would commend itself to every individual or firm connected in any way with the building trade in Canada, whether general contractor, sub-contractor, or dealer in builders' supplies. He invited the Board to express itself so that definite action might be taken.

Mr. W. E. Ramsay stated that for years he had advocated a plan whereby each and every trade employed on construction work could be fully organized within itself, and its members deal with matters that belonged to themselves exclusively and yet be fully represented in the Builders' Exchange.

The President pointed out that this was already carried out in two sections at least of the Exchange. In the case of the Mantle and Tile dealers their chairman for the current year was by virtue of his office a director of the Builders' Exchange; while in the case of the Master Plumbers' Association, its members preferred to have on the Board of the Exchange their immediate past president. The general contractors' section intended to have this matter up at a special meeting, to be held on November 19, when a resolution would be moved that the chairman of this section for the current year be also a director of the Exchange. He had no doubt but their resolution would be carried. Another section was already getting busy to be thoroughly organized and represented. He referred to theElectrical Contractors, who were being ably lined up by their fellow director, Mr. H. Vincent. Mr. Ramsay's plan was undoubtedly a good one and merited attention, but he would like to see the organizations of the sections speeded up, and he thought the supply firms who were members of the Exchange should have their separate section.

On the motion of Mr. W. E. Ramsay, seconded by vice-president W. M. Irving, it was unanimously resolved to refer the whole question of the better organization of the Exchange to the membership committee, who will report to the next meet of the Board.

The president intimated that a deputation of the Exchange had been invited to meet the council of the City of Westmount to consider the operation of the building by-laws of that city and matters of a similar nature. On motion of Mr. A. Rutherford, seconded by Mr. A. H. Webster, the following were appointed to represent the Exchange: President J. P. Anglin, past-president John Quinlan, vice-president W. M. Irving and Mr. W. R. J. Hughes, vice-president of the Master Plumbers' Association.

The use of the rooms of the Exchange for the annual convention of the Canadian National Clay Products Association, to be held on May 26, 27 and 28, was granted.

Three women are now included in the membership of the London, Ont., Board of Trade, and it is planned to greatly increase this number in the near future.

Algal Growths and Chlorine Treatment of London Waters[*]

Treatment of Algal Growths. It has frequently been pointed out that in algal treatment the offending growths can be destroyed, yet the risk may remain of other and more resistant growths taking their place. A notable instance occurred in 1917 during the continuous treatment of No. 1 reservoir at the West Middlesex Works with copper sulphate (1 in 4 millions). The growths (Fragillaria, Asterionella, Stephanodiscus, filamentous confervoid growths, etc.) affecting the neighboring reservoirs were almost completely held in check, but a fresh growth, composed of such excessively minute cells that they pass readily through four folds of fine linen, developed abundantly and caused serious blocking of the filters. Incidentally, this result shows that linen filtration results cannot always safely be compared with slow sand filtration.

In August, 1915, a very decided growth of Stephanodiscus occurred in the Stoke Newington reservoirs, causing rapid choking of the filter beds. At the beginning of July, 1917, a very similar growth (Cyclotella) began to develop, but the part played was no longer a passive one. By a judicious combination of chlorine and copper sulphate treatment the filtration difficulties were entirely overcome, no water was wasted, and the use of the reservoirs as settling and purifying agents was practically continuous. The procedure was to shut off the west reservoir for a few days, whilst it was being treated with copper sulphate (1 in 2 millions, and a short-circuit chlorinated water through the east reservoir on to the filter beds. A recrudescence of the growth occurred later on more than one occasion, but it was each time dealt with in a similarly successful manner.

Effect of Algal and Other Growths in Water Purification.—The role played by these organisms in connection with water purification is not fully understood. Some of them exercise a useful function in reducing the hardness of water and, within certain limits, in increasing the effectiveness of the protective film formed on the surface of the sand filters. On the other hand, they may sometimes give rise to taste troubles, and when superabundant "seal up" the filter beds so rapidly as to disorganize the whole machinery of sand filtration. In the latter event, although in themselves quite harmless, they may lead to imperfectly purified water being sent into supply. Those who have studied these matters know that the simultaneous occurrence of heavy floods, abundant growths (especially those kinds which readily block filters and give rise to taste troubles) in the reservoirs and increased consumption of water might create embarrassing, if not serious, condition of affairs. How far algicidal treatment, chlorination of river water, and the use of filters, which can be cleaned as rapidly and as often as the necessities of the case demand, are destined to enter into the problem, must be left for the future to decide.

Chlorination of Raw Water.—This year a cautious opinion must be expressed, not of the efficacy of chlorine as a germicidal agent, but of the difficulties still to be overcome of adding this reagent to water in the proper dose. With the particular apparatus used, quite successful results were obtained during the warm weather, but when the air and water temperatures fell below a certain point, troubles were not far to seek. So far as the instrument was concerned, these difficulties were largely overcome by artificially heating the temporary building in which the apparatus was "housed." Yet this procedure availed nothing as regards that part of the instrument which lay outside the building and was indeed immersed in the water. It is now evident, as the result of practical experience during the cold weather, that either the gas must be added as a solution to the water to be sterilized, or else some improved form of porous diffuser must be discovered. The matter is still under active investigation.

For the period April 1, 1917, to March 31, 1918, 23,426 million gallons of raw Thames water have been treated during 315 days (West Middlesex supply) and 313 days (rest of Staines supply) out of a total of 365 days. The intermissions, of course, were caused by floods, when the water was too turbid for filtration purposes and stored water had to be used instead. The proportions were 84.3 per cent. raw water and 15.7 per cent. stored water during the year. The estimated saving of coal amounts to about £15,227. The cost of the chloride of lime was about £3,485. The net saving by reduced pumping thus amounts approximately to £11,742.

The dose has varied according to circumstances, but was usually 0.5 in 1 million (1 in 2 millions), in terms of available chlorine. With bleaching powder (chloride of lime) of 33 per cent. strength this equals 15 lb. per 1 million gallons. Considerable success, however, has also been obtained with smaller doses, 0.33 in 1 million (1 in 3 millions), or 10 lbs. of material per million gallons. On the whole, the latest results point to a probable reduction rather than an increase in the average dose. As regards bacteriological results, all that is now aimed at is to produce at least as good a result by chlorination of raw river water, as if the river water had been stored in the Staines reservoirs instead of being chlorinated. The Staines stored water 10 cc. B. coli standard is 60 per cent. "negatives" (40 per cent. "positives"). That is, if 100 cc. cultures are made of Staines stored water, 60 of them, on the average, contain no B. coli, and 40 of them contain this microbe. Taking a period embracing the bad winter months, namely, from October, 1917, to the end of March, 1918, the average chlorinated raw river water result works out at 83 per cent. "negatives" and 17 per cent. "positives," figures which show that better results, as judged by the B. coli test, can be obtained by chlorination than by storage. Despite the magnitude of the treatment (70 to 80 million gallons treated daily), no complaints have been received as regards taste.

Super-Chlorination and De-Chlorination.—The two great factors which militate against successful clorination are extreme cold and short contact. Separately, and still more in conjunction, they tend to prevent sterilization, or if sterilization takes place owing to a super-dose, the water is apt to have a chlorinous taste and to contain active chlorine. By a super-dose is meant a dose in excess of what is actually required under more favorable working conditions. It is always best to provide for so prolonged a contact that however cold the water may be, the active chlorine will have disappeared and the water at the same time have been sterilized. In practice, however, for one reason or another, this may be impossible, and in these cases, especially during very cold weather, super-chlorination and de-chlorination may be of advantage. There is another curious circumstance bearing on the question. It has sometimes been observed in the laboratory that when working with minute doses of chlorine, too slight to produce the familiar chlorinous taste, a slight "iodoform-like" taste develops. This occurs sometimes after a water has been de-clorinated, at other times it is noticeable only before de-chlorination, yet again it may occur both before and after de-chlorination. On the other hand, no taste, unless perhaps the original taste, has ever been observed after gross chlorination and de-chlorination. Hence in certain cases there may, so far as taste is concerned, be an advantage in heavily chlorinating a water and then de-chlorinating it.

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[*] From a report by Dr. A. C. Houston, Director of Water Examination, Metropolitan Water Board, London.

On the whole, speaking of the samples neutralized with SO_2, neither temperature nor time appeared to be dominating factors as regards questions of taste.

Next in respect of dose, the amounts (in terms of available chlorine) were as follows: 1 in 15,625, 31,250, 62,500, 125,000, 250,000, 500,000, and 1,000,000, respectively.

The outstanding feature was that with the stronger doses (far greater than would ever be required in practice), despite the extremely noticeable and practically unbearable chlorinous taste of the non-neutralized samples, the ones neutralized with SO_2 were completely free from any taste. Indeed, the slight earthy flat taste of the river water often noticed appeared to be removed or disguised, not infrequently, by super-chlorination and SO_2 treatment. Apart from cost of materials and the circumstance that the substances (Cl and SO_2) are not separately innocuous in other than minute doses, the indication is that a combined (in sequence) super-chlorination and SO_2 treatment may be actually advantageous from the point of view both of taste and of sterilization. When, however, the case is regarded from the economic aspect and in relation to the undesirability of using in other than infinitesimal doses substances which apart are not, in the uncombined form, natural ingredients of water, the matter assumes a diffrent complexion. Unfortunately, it is just when the minor doses come to be considered that many of the difficulties arise. Sometimes with, sometimes without SO_2 de-chlorination, but quite as often as without, taste results are obtained, which lead to nebulous conclusions.

Shaft Sinking by Freezing Process

THE freezing process was successfully employed in sinking two shafts through water bearing ground at the Llay Hall Colliery, Wrexham, England, and is described in "Engineering and Contracting." Two foreshafts were sunk 12 ft. deep and 31 ft. in diameter and lined with brickwork. Concrete was placed on the bottom after inserting straight vertical guide tubes for 25 bore holes distributed around a circle 26½ ft. in diameter. In the upper strata the holes for the freezing tubes were bored by the rope method, but in the lower and harder ground percussion apparatus operated by a steam cylinder was used. The cold necessary for freezing the water-bearing ground was applied by two distinct groups of machines. The pipes and valves were arranged so that either group of machines could operate on either shaft or on both simultaneously. Each included a belt-driven ammonia compressor with an independent horizontal steam engine having cylinders 16¾ in. in diameter and 30-in. stroke. A solution of calcium chloride was used as the freezing liquid and was caused to circulate between the refrigerators and the freezing tubes by means of two plunger pumps. The brine pipe between plant and shaft was insulated with hair felt. The ground was frozen to a depth of 231 ft. in the first and 235 ft. in the second shaft. The diameter of the pit shafts after lining is 18 ft.

Welding by Alternating Current

There has recently been introduced to Canadian manufacturers an electric arc welding machine under the name "Mephisto" welder, which operates on alternating current. The machine has no moving and, therefore, no wearing parts, or upkeep cost; is entirely self-contained; heat losses due to resistance, etc., are practically nil, all the heat being concentrated in the small arc. There is no danger, therefore, of burning or crystallizing the work on either side of the weld as the only material subjected to heat is the weld itself. The current consumption is 3½ to 4 kilowatts. This, with a power rate of, say, two cents per kw.h., would not cost more than one dollar per day for power.

The machine, which is built for any voltage or frequency, is very simple to operate and does not require any expert to handle it. It is not necessary to preheat the work, except in the case of heavy cast iron, and the weld, when completed, is not brittle or hard, but can be easily machined down. There are a large number of these welders in service both in Canada and the United States, and the manufacturers say that in every case they have given entire satisfactin. The "Mephisto" welder is manufactured by the Arcwell Corporation of Canada, 710 C. P. R. Building, Toronto.

The American Road Builders' Association will hold its annual convention in New York on February 25, 26, 27 and 28.

Electric Welding—A New Industry

By Mr. H. A. Hornor*

About a year ago the Chairman of the Standards Committee of the Institute was requested to investigate and standardize spot welders and the apparatus connected with them. It occurred to the members of this committee that electric welding could perform an important function in increasing the progress of steel ship construction. The work which was started by the Standards Committee was then transferred to the General Engineering Committee of the Council of National Defence. Last winter the Council of National Defence abolished all advisory committees but at this time the Emergency Fleet Corporation of the U. S. Shipping Board had become so much interested in the subject that they decided to adopt the committee. The committee is composed of representatives covering broadly the whole field of welding activities in this country and, although electric welding has been the subject of all the investigations up to the present time, it is now proposed to include gas welding with representatives from all the gas welding associations and companies connected with the industry.

The two main processes of electric welding, namely, arc welding and spot welding, were found by this committee applied in the first case to repairs and in the second case to certain factory quantity production jobs. The work done was in the case of spot welding only on light material, and in neither case very extensive. The processes to be successful in their application to the construction of merchant vessels would have to show reliability in the joining of steel plates from a half-inch to one inch in thickness. To this and kindred problems the committee immediately turned its attention.

The work had all been done in the field where it had been applied by practical men. It was first necessary to formulate the proper nomenclature and symbols. This was thoroughly investigated and a very comprehensive set of symbols has been approved by the committee and is in daily use by those now actively engaged in this new application. The approved nomenclature introduces the subject to the designing and calculating engineer and gives him the instrument by means of which he is able to place his thoughts rapidly and conveniently on drawings.

The manufacturers of apparatus joined the practical man in the study of the problems of electric welding. Apparatus and so-called processes introduced various types of machines suitable for the conversion of electrical supply to the proper values of current and voltage needed at the arc or at the spot. The manufacturer in his eagerness to meet the problem naturally encountered many difficulties. These difficulties increased until a point was reached as referred to above where he demanded some standards upon which his apparatus could clearly be rated. Therefore, the manufacturer was only too pleased to co-operate with the Welding Committee and is to-day conscientiously aiding in straightening out the difficulties in which he was involved prior to last year.

Arc welding in this country has largely been done in the railroad repair shops. It was discovered that the process was much cheaper and could be performed more rapidly than by any of the gas welding methods. It also could be applied without preheating and in many cases without the expense of disassembling complicated pieces of machinery. Spot welding besides being used in many different industries was sought for by the railroad man and there has been built a gondola car which has seen some seven or eight years of service. It is interesting to note here the difference in practice between Great Britain and the United States. The former knowing little or nothing about spot welding had the practice and application of arc welding very well under way; the latter exactly the reverse.

Apparently the attempts to train operators were rather crude and it was early observed that the reliability of the electric weld depended substantially upon the skill of the welder. The manufacturers of apparatus and the superintendents in railways shops had struggled with the problem of training operators but intensive study had not been given the subject so that there existed in this respect a great deal of groping in the dark.

Present Status of Electric Welding.

Investigations were immediately undertaken to answer the question whether spot welding could be successfully accomplished using one-inch thick steel plates. An experimental apparatus of large size was erected and put into operation, the results showing that no difficulty was encountered with half-inch and three-quarter inch plates. The same remark applies to one-inch steel plates. In fact, this experimental machine was successful in welding three thicknesses of one-inch plate a condition which far exceeds the requirements of merchant ship construction. This operation has its historical significance in that this was the first time that any spot welding of this magnitude had been performed. The successful outcome of these experiments has led to the design and construction of large spot welders to be used in the fabrication of ship sections. The practical application of a large five-foot spot welder will be made at a demonstration of a forty-foot section of a standard 9600-ton ship to be built at the plant of the Federal Shipbuilding Company, Kearney, New Jersey. This is the largest portable spot welder ever built. It will prove two points in ship construction by the electric method, namely, the clamping of the ship's structural parts for assembly thereby reducing the time in working the material as well as for the erection of the ship material; and secondly, by the speed of spot welding it will prove the decrease in time for joining the material together. The consensus of opinion is that the large stationary spot welder of five or six-foot gap will undoubtedly play an important part in increasing the speed of fabricating sections of standard steel vessels. Further investigations are being made and designs are being worked out for special spot welders for use in the construction of bulkheads. The designs proposed are chiefly for shop processes, but it can be asserted that such apparatus will be of undoubted value in the saving of time and man power.

Arc welding had been tried in a great variety of work but there was no conclusive evidence that it could be developed to the stage of joining ship plates with the certainty of full strength. The first stage of this investigational work is now almost completed. Sample welds of half inch ship structural steel were taken by a special sub-committee to fourteen or fifteen different places where electric welding was done, noted the conditions of current, voltage, electrode, operator, etc., and then prepared the welded samples for tests. The samples were forwarded to the Bureau of Standards in Washington so that the tests should be conducted by parties absolutely disinterested and without knowledge of how the samples were obtained. The results of these tests showed a remarkable similarity especially when it is realized that they were made by several firms with different electrode materials and under varying conditions of the electrical current. Practically all of the welds pulled at over 50,000 pounds per square inch and several over 60,000 pounds the average being about 58,000. On the bending test one of the samples was bent to an angle of 78 degrees before a crack started and final failure reached 80 degrees. In another case the sample was bent to 65 degrees before the crack started and final failure did not occur until 86 degrees. The point of importance here is that all the welds showed a reliability and satisfactoriness which makes conclusive the opinion that electric arc welding is applicable for the joining of steel where the structure is submitted to live loads, bending strains, static pressure, or the like. The Sub-committee on Research is pursuing this subject and practical samples are being prepared for similar tests using three-quarter and one-inch stock material. The results of these tests will be available as soon as the reports are presented and approved by the Welding Committee. The Research Committeee is also preparing various types of joints in heavy plating. These will be submitted to all the regulation tests and in addition to shock and fatigue tests and tests to destruction.

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*Read before the A. I. E. E.

To give a further indication of the large size practical tests which are being carried on at the present time it may be stated that three 12-foot cube electrically welded tanks are now being constructed. These tanks are built in such a way that from twelve to fifteen different designs of joints are used in their construction. After these tanks are built they will be subjected to a static strain and the deflection of the seams will be directly measured. Afterwards they will be tested by external shock and crushed to destruction. Portions of the joints will be cut, sent to the Bureau of Standards, and again tested for the sake of accumulating precise data. In this connection there is being built at the Norfolk Navy Yard a battle-towing target. The keel of the target 110 feet long will be entirely electrically welded and the results of this practical demonstration will be carefully recorded after it has been put in regular service.

Alternating Current Found Advantageous.

It is to be expected that the manufacturers of apparatus being keenly observant of the increased interest in electric welding as well as in the future, which is probably now unquestioned, would be active in their desire not only to improve their present facilities and their design of apparatus, but also to proceed themselves to follow the trend of the investigations made by the Welding Committee. The consequence of this has been a large increase in output of apparatus that is needed. One interesting point is that certain manufacturers who were decidedly of the opinion that direct current was the only proper current to use for arc welding have within a very recent period changed their point of view and are willing to admit that alternating current may have certain advantages in the development of this art.

The electric arc requires a reduced voltage and this is difficult to attain with direct current without relatively expensive machines or a useless expenditure of energy. The practice in this country in manufacturing establishments of any size has been toward an increase in the supply voltage so that very few large manufacturing plants use less than 220 volts direct current. With this voltage the only economical method of transformation is in the use of a motor-generator set. The efficiency in this case is in the neighborhood of 50 to 60 per cent. It is possible to use a supply voltage of 110 volts with a variable resistance which cuts down the voltage to the arc volts. This gives a very poor efficiency. In the case of alternating current the supply voltage can be reduced by a transformer which will supply as in the case of direct current a sufficient voltage for striking the arc and a satisfactory reduction when the arc has been struck. On the other hand, if a low voltage alternating current is provided a simple reactance may be introduced which has some of the same wasteful characteristics of the resistance used with the direct current. The average apparatus will permit of electric arc welding consuming about six to eight kilowatts per welder, but if low voltage is provided there are certain outfits which will reduce the consumption as low as three and one-half kilowatts per welder, or even less.

Without entering into an elaborate analysis of the relative costs of electric welding, it may be broadly stated that there is hardly any question that the electric process is cheaper than any other. The same may be said as regards speed and also reduction of man power. In a recent discussion of this subject President Adams stated that at one of the Eastern shipyards the total number of parts on the welding program of the standard riveted ships now building at that yard amounted to 225,000. The labor cost for riveting these pieces is about 245,000 dollars and for welding about 99,000 dollars making a saving of 146,000 dollars. But this is only a drop in the bucket when compared to what might be profitably done in this line. He stated further that in certain particular instances the saving is as great as 90 per cent.

One of the interesting questions discussed with some fervor by the members of the Welding Committeee is the advantages of the bare and covered electrode. Regarding this discussion no definite facts can be stated. In England the practice has been to use the covered electrode which protects the welding arc from contact with the air thus guarding against too great a formation of oxide. The practice in the United States up to the present time has been largely bare wire. Recently, American investigators have discovered the important fact that there are advantages in the covered electrode and many experiments are now being made, some with results. It is important to observe that in the above mentioned tests of welds, the best one of these samples was made with a coated (not an asbestos covered) electrode using alternating current. The point in this case seems to rest upon the question of the ducility of the weld and it would seem that the bare electrode does not make as ductile a weld or at least one as easily bent as the coated or covered electrode. The question of the ductility of the weld is one of much importance in the application to ship construction and will doubtless be of importance to other allied industries. It is, therefore, a question of serious importance and constitutes an important part of the work of the Sub-committee on Research.

No matter what the type of electrode is nor its composition, no matter what kind of shank material is to be welded, no matter what kind of apparatus is employed, the reliability of the weld rests mainly upon the man who welds it. This man if he has been properly trained and is skilled in the art knows instantly whether he is making a weld or not. He becomes after much practice able to judge fairly well upon looking on a finished weld whether it is a good weld or not. The work of training electric welding operators early became a part of the functions of the Education and Training Section of the Emergency Fleet Corporation. The men connected with this work are members of the Welding Committee. Schools for the training of operators as well as for the conversion of operators into instructors, are established in many parts of the country. The objects held in view by the training department are first to give the man intensive practice work so that he becomes a good craftsman. The methods are simple to start with, as the exercise of the right arm muscles must become flexible enough to permit the operator to give the required movement to the electrode. By a graduated series of exercises this is accomplished in about eight weeks. The man is allowed to do production jobs in the shop which gives him confidence through responsibility. It becomes desirable at this time to give the man some outside work on ships and where this is practicable it is done. The man is then turned over to an instructor who gives him an intensive course in pedagogics lasting from five to six weeks. At first sight it would not seem necessary to so instruct a man but it is not generally understood that teaching after all is itself a trade. The experience with the men in this respect is most interesting. In nearly every case the man has resented this course at the start but at the end has turned completely around and in many cases has desired an even more extensive training. What is really accomplished is to give the man the necessary confidence to impart the knowledge that he has gained to another green man. The men under training are taken from the various industries especially the shipbuilding industry and after they have finished their instructor course are returned to their employer to carry on the instruction, in their own plant. The men who go through this training as provided by the Emergency Fleet Corporation are certificated when they have shown themselves to be entirely proficient. It is not possible nor expedient for the Emergency Fleet Corporation to require the certification of all electric welders. It is the consensus of opinion that all industries doing serious work with the electric arc should use men who are certified as to their ability in the art of electric welding. The main reason for this opinion is that the operator must be a conscientious workman or the weld will not be of perfect quality.

This brings forward another problem upon which a great deal of experimental work has been and probably will continue to be done, namely, a practical and scientific method of testing a welded joint it has been made. There have been a number of suggestions made for the solution of this problem. They are briefly, as follows:

(a) Mechanical. By hammering the weld or by chipping at frequent intervals.

(b) Electric. By means of resistance or voltage drop.

(c) Magnetic. By means of the permeometer or the change of conditions of the magnetic circuit.

(d) X-ray. By means of an exposure on an X-ray plate.

At the present time none of these suggested methods have been productive of conclusive results and recourse must be had to the purely mechanical methods of striking heavy blows on, or adacent to, the weld or by using a chipping hammer and making intermittent examinations. It would seem by far the best procedure to make the inspector proficent in the art so that he may closely observe the welders while at work. This may be accomplished by a two or three weeks attendance of inspectors at any one of the electric welding training centers.

Methods of Electric Welding.

There are many methods and processes of electric welding but the two main ones that interest the committee at the present time and alone have been mentioned so far are the spot welding and arc welding. It may be a surprise to some of the old time welders to consider electric welding as a new industry. In substantiation of this statement it may be well to describe briefly what is meant by electric welding as it is practiced to-day.

Spot welding is not much different in the methods of procedure or in design of apparatus than when it was first introduced. Copper electrodes, water-cooled in the heaviest machines, are placed on opposite sides of the material to be welded together. The joint is a lap joint. Machines are now so designed that two spot welds may be made at one time. The routine of the operation is as follows:

The electrodes are brought into contact with the materials to be joined, current is supplied sufficient to give the required heat, pressure is then applied, the current is removed, and the pressure is removed, the weld is then complete.

The operator has a perfect indication of making a good spot weld by the use of a button placed under the electrode observing which he knows exactly the proper timing of the operation. There is therefore no question as to a good, bad, or indifferent, spot weld. Automautic spot welders have been designed and built, but it is the general opinion that they add complication to a process which in itself is very simple.

The process of arc welding is as follows:

One side of the electric circuit is connected to the material to be welded, the shank material is usually prepared by bevelling the edge of the pieces to be welded together. The other side of the electric circuit is connected to the electrode. By touching the electrode to the shank material the arc is drawn. The skilled operator now moves the electrode from side to side of the groove giving a semi-circular motion while at the same time moving the electrode along the groove.

It is important that the arc "bite" into the shank metal creating a perfect fusion along the edges and the movement of the electrode is necessary for the removal of any mechanical impurities that may be deposited. In the coated electrode it is further necessary that the slag which forms for the protection of the pure metal be worked up to the surface and it is extremely important in the event of a second or third layer that the slag or impurities be carefully scraped away before the virgin metal is again laid on.

The operator in arc welding is protected with either a hand screen covering his face with special glass through which to observe his work. The electric arc emits dangerous invisible rays in both the upper and lower spectrum scale and it is quite evident that both the infrared and ultraviolet are dangerous in their effect, the former is pathological the latter actinic. The operator further uses gloves for his hands and for the very difficult work of overhead welding it is necessary for him to use a helmet which partly covers his breast.

Developments.

The tendency of developments in spot welding has already been slightly touched upon. In their nature as applicable to shipbuilding the advancement will naturally have to proceed toward means for accomplishing spot welding in very cramped locations. This makes an exceedingly difficult problem as the power requirements are such as to preclude any very small device. In riveting one-half of the apparatus is on one side of the work and the other half on the opposite side and it is difficult to conceive of any method of spot welding that will admit of such an arrangement. In shipbuilding it is quite probable that designs may be made that will permit of a large or at least increased amount of spot welding in the actual construction of the vessel. Certainly, present designs of riveted ships will not allow of this to any great extent. As already stated, spot welding can now take its place in the fabricating shops and it is to be expected that within a few months spot welding will begin to supplant riveting in this field. The only drawback to this will be the sufficient production of spot welding apparatus.

The tendency of development in arc welding is toward the automatic machine to obviate the responsibility that has to be placed upon the skilled operator. Intensive work has been done within the last few months in the line of automatic arc welding machines and at the present time sample tests of welds made by such apparatus have been sent to the Bureau of Standards. These machines will occupy a very important position in repetition work. They will not immediately supersede the skilled operator in repair work, or in special jobs but it may be expected that the development of such machines will bring apparatus which can be man-handled and will eventually take the place of most of the hand work as it is now known.

Of the scientific advancement in the art of electric welding there is so much to be treated that only a general outline can be considered at this time. The research work has only just begun. Practice has preceded the scientific investigation.

The field, therefore, is full of most interesting problems. Those who have been following the development of the past six months are deeply interested to know the fundamental reasons. The investigational questions may be grouped into three main divisions:

1. Metallurgical; 2. Physical; 3. Electrical.

The metallurgist has yet to tell us what the conditions of the metals are after the electrode material has fused with the parent metal, and to determine what the proper conditions must be to produce a good weld. This problem has in it a great many variables. The physicist must explain the atomic or electronic conditions which permit of the combinations at the high temperatures involved and must explain the phenomenon of overhead welding. The electrical investigator must determine all the various phenomena connected with the preferences between and the advantages of the use of different forms of electrical energy and the varying characteristics of the electric circuit in producing different type of welds.

Conclusion.

From the preceding remarks it must be conceded that the Welding Committee of the Emergency Fleet Corporation has already crystalized the problems connected with this art. The working functions of this committee have been laid down upon the broadest possible lines. Liberal opportunity has been given every one to state in detail his opinion and to express the reasons for his preference on every point connected with this subject. The committee goes even further than this. It furnishes those interested with every new idea that is brought to bear upon the subject after sifting from the suggestions any question of doubt or misstatement of fact. All suggestions of improvement or problems of special application are gladly taken in hand, thoroughly investigated and reports made. It will welcome any comments that those connected with the industries may desire to lay before it. The personnel is at the present time such that it can devote not one but many minds to the solution of any specific problem that is laid before it.

The committee early discovered that the literature of electric welding was very much clouded by misstatement of fact or half-baked theory and much of the time of the committee has been taken up in disproving such statements. In order to spread the results of this work to all quarters a handbook is now being prepared which will contain only definite facts and results of investigations as are approved by the whole committee. This handbook will be made available to all those who desire to acquaint themselves with the proper means of accomplishing good and reliable electric welding.

Obituary

Mr. Frank Hunt, plastering contractor, of Ottawa, was fatally injured on Nov. 6 by the breaking of a scaffold at the new Detention Home in that city. This scaffold was about 18 or 20 ft. above the ground, projecting from a second-storey window. It broke without warning, causing Mr. Hunt to fall heavily to the ground, and his death ensued before the hospital was reached. It is stated that the unsafe condition of the scaffold had previously been pointed out to Mr. Hunt, but that he had apparently considered it sufficiently secure.

Ford C. Bowman, manager of the waterproofing department of the Philip Carey Co., Lockland, Cincinnati, Ohio, died of influenza pneumonia, on Oct. 26. Every attention medical science could afford was given without avail. Mr. Bowman joined the staff of the company nearly eight years ago, and had established himself as a most valuable member. He is survived by his widow and a little son.

Mainly Constructional

East and West—From Coast to Coast

The Couverapee Mining Co., Limited, has been incorporated, with a capital of $100,000, head office at Field, B.C.

The British Government Housing Board proposes to erect 300,000 homes in England the first year after the war, and 100,000 homes in Scotland.

The city council of Sydney, N.S., will in the near future raise the price of water to the Dominion Coal Company from 8 cents per thousand gallons to 15 cents.

The Whitmarsh Mining & Development Company, Limited, has been incorporated with a capital of one million dollars, headquarters at Quesnel Forks, B.C.

The Moody Rolling Mills, Limited, have been incorporated, with a capital of $20,000, head office at Vancouver. This firm is authorized to carry on business as ironmasters, steel-makers, iron founders, etc.

The council of Ford, Ont., has awarded the contract for the construction of an intercepting sewer in the west end of that municipality to the Chick Contracting Co. of Windsor. The work, which is estimated to cost $537,215, is to be started immediately.

The employees of the Algoma Steel Coroporation, Sault Ste Marie, and the representatives of the company, have come to an agreement in the dispute regarding wages, hours and overtime, whereby the employees receive increases aggregating about $900,000 in the wage roll for the year.

The Cochrane Board of Trade has passed a resolution urging that the Ontario government proceed with the extension of the Temiskaming & Northern Ontario Ry. to James Bay. A copy of this resolution, which points out numerous advantages to be gained from the carrying out of this undertaking, is being sent to Ontario cabinet.

The work on the trunk sewer, which the railway board ordered to be constructed between the west end disposal work in Hamilton, Ont., and the McKittrick survey, is to be proceeded with. At a recent meeting the city council recommended that 1,200 ft. of the sewer be built at once. Half of the cost is to be paid by the McKittrick Properties, Limited.

The annual meeting of the Greater Toronto Labor party was held in the Labor Temple on Nov. 9. Two sessions were held and numerous changes were made in the constitution and by-laws of the party. The following officers were elected for the ensuing year: president, Mr. Jas. Ballantyne; vice-presidents, Mrs. W. F. Singer and Mr. J. T. Gunn; financial secretary and treasurer, Mr. Roy Hughes; recording-secretary, Mr. J. W. Buckley; also an executive of about 20 members.

Personals

Mr. Lloyd Harris, who has done good work as chairman of the Canadian War Mission in Washington, has now been appointed chairman of the Canadian Trade Mission in London, England.

Mr. T. A. Stevenson, president of the Toronto Typographical Union, and secretary of the Toronto District Labor Council, has been appointed as the representative of labor upon the Department of Soldiers' Civil Re-establishment.

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What the Alsace-Lorraine Iron Mines Have Meant to Germany

An interesting sidelight is thrown on the future industrial competition between Germany and France and her allies, in an editorial article under date of Oct. 18, in the British "Engineer." At that date it had just been announced that Germany accepted President Wilson's general terms, and the editorial expressed doubt as to the possibility of German industrial authorities ever consenting to the release of the iron mines of Alsace-Lorraine. Read in the light of intervening events, the article is specially interesting as pointing out the position Germany now finds herself in with regard to a supply of iron ore. Extracts from the article follow:

"It is advisable to emphasize the paramount importance of the question of iron ore resources as affecting Germany, with special reference to those in German Lorraine as forming part of Alsace-Lorraine. Let us therefore clearly understand what the position of Germany will be without German Lorraine, and without the ore resources of the further innocent victim of German aggression as represented by the Grand Duchy of Luxemburg. It is found, for instance, that the production of iron ore in Germany in 1913 amounted to 28,607,000 tons, whilst that of Luxemburg—which is included in the German Customs Union—was 7,333,000 tons in that year. In the same year, the imports of iron ore, apparently forced for war purposes to the extent of 2,000,000 tons more than in 1912, reached the record total of 14,000,000 tons. If from these first figures we subtract the output of iron ore in German Lorraine, which amounted to 21,136,000 tons in 1913, the surrender of Alsace-Lorraine to France will mean that Germany was left only the insignificant quantity of 7,471,000 tons per annum, on the basis of the native production in 1913. If, however, the tonnage won in Luxemburg remains at the disposal of Germany, and the imports are maintained at the extraordinary level which prevailed in 1913, Germany will still only have 28,800,000 tons of iron ore per annum for smelting purposes, as compared with 49,940,000 tons in 1913.

But even if, owing to her financial grip of Luxemburg, Germany is still able to draw on that country, it is a question whether she will again be afforded an opportunity of procuring, for a long time to come, such a large quantity of iron ore from abroad as was imported in 1913. Out of the total of 14,000,000 tons purchased from other countries in that year, France, Greece, Algeria, Tunis and Newfoundland supplied 4,700,000 tons, Sweden 4,558,000 tons, and Spain 3,632,000 tons, making a total of 12,890,000 tons, whilst the balance was obtained from Russia and other countries. Most of the imports were of ore of special and superior qualities to those won in Germany. If the necessity for France to exchange iron ore for German coke should be overcome, the supplies from France, Algeria and Tunis would be stopped, and those from Newfoundland and Greece also would probably cease; but it has yet to be shown that France can obtain adequate supplies of coke from any other country. On the other hand, the tendency in Sweden is to curtail the export of low phosphoric ores in favor of the development of the native iron and steel industry, and Spain may be expected to follow in the same direction, so that the probability exists that Germany will be unable to procure such large quantities of iron ore from abroad in the future, unless other foreign sources become available as, for instance, Brazil. Now, since it must be observed that the reported acceptance by Germany of the terms put forward by the President of the United States implies the evacuation of France, including the iron ore districts of Briey and Longwy, it is of interest to note the estimation in which Germany holds this rich district. The Verein Deutscher Eisen und Stahl Industrieller and the Verein Deutscher Eisenhuttenleute, in the course of a petition presented to the Imperial Government last year, asked for the incorporation of Briey in the German Empire, on the ground that without these deposits Germany could not carry on a future war with success. On the outbreak of the war, there were eighty-nine blast-furnaces in the Meurthe and Moselle, which produced 3,410,000 tons of pig iron out of the total make of 4,950,000 tons in 1912, and the steel furnaces there turned out 2,210,000 tons out of the total of 4,440,000 tons of steel made in 1912. It was stated some months ago, by the Vossische Zeitung, that all the works in the district have been demolished, particularly the blast-furnaces, solely for the purpose of yielding scrap iron; and the Briey district merely consists of "some square miles of uninhabited territory;" but on the other hand, it was asserted at a meeting of the Deutscher Eisen und Stahl Industrieller, last December, that 11,500,000 tons of iron ore had been obtained from the Briey district in three years and a quarter, and that the production at that time was equivalent to 550,000 tons per month.

Since then, however, the German steel trade associations have abandoned the idea of annexing Briey, but propose that the Briey basin should be jointly utilized by the two countries by means of concessions or contracts. Yet even these modifications will have to be relinquished in consequence of the voluntary or compulsory removal of the German from France in a future not remote.

When the French recover possession of the Meurthe and Moselle, and if it should be decided to re-establish the iron and steel industry there, as, despite the alleged vast ore deposits in Normandy, is so probable that it amounts to a certainty, one of the most pressing problems which will arise will be the obtaining of an adequate supply of coal and coke, and the fuel question will become of even greater importance with the enforced return of Alsace-Lorraine. The only country which can meet this demand is Germany, and necessity may compel the French again to exchange iron ore for coke, as in former years. But even then Germany can not expect to regain the prominent position which she occupied before the war in the iron and steel, engineering and shipbuilding industries, and her financial position will consequently suffer for many years to come for this reason, and for the further burdens which the war will impose upon that country. We are not far wrong in saying that the war is a war for iron, the commodity on which industry reposes, and bearing in mind the enormous value to Germany of the districts we have been considering, we do not believe she is yet ready to surrender them, and we, therefore, accept with reserve her avowed consent to evacuate the occupied iron districts of France, and to give back Alsace-Lorraine; we hold it safer to assume that by some wile she still hopes to retain her grip on resources which are of unparalleled consequence to her future development.

Can a Municipality Hold Contractor's Deposit?

IS a municipality justified in holding the deposits of contractors who have failed to live up to their agreements and who have done a certain amount of work for which payment is due and has not been made? This question arises out of the building of the La Salle bridge, Montreal, a perspective of which appeared in our issue of November 6. The bridge is over the ill-fated aqueduct, which is now lying derelict, after the expenditure of millions of dollars.

The bridge has had a history almost as unfortunate as that of the aqueduct. The contract for its construction was originally awarded to Mr. J. Sullivan at a price which was considered to be very low, and which caused considerable surprise to competing firms. Mr. Sullivan fell down, and the job was turned over to Pion and Grothe, at a price of $259,000. In turn, the work was again stopped, the contractors alleging that the price of materials was so high that they had no alternative but to abandon the contract. They wanted the contract cancelled, but the City Commissioners declined, and insisted that the work be proceeded with. As nothing was done, the city, as in the case of the first contract, claimed the machinery and material on the ground. The city then decided to complete the job, and appointed Fraser, Brace & Co. to supervise the work for a fixed sum.

The sum deposited by Mr. Sullivan was $21,000, and the work done was valued at $15,000. Pion and Grothe made a deposit of $25,939, in addition to which there is due a balance of $51,000 for work done. The question came before a committee of the Council, and efforts were made to get a recommendation in favor of the moneys being reimbursed to the contractors, without profits, on the ground that the changed conditions, due to the war, were responsible for the failure of the contractors to live up to their engagements.

The commissioners of the city take the position that, as trustees of the tax-payers, they are responsible for seeing that the work is carried out without loss. If the job costs more than the contract price then the city may rightfully make up any deficiency from the deposit money owing to the contractor who failed to carry out his agreement. It is therefore held that the city ought not to lose its hold on the money until the job is completed.

Lumber Industry in Canada

THE lumber industry, one of our chief resources in Canada, was most seriously affected by the war. Our foreign markets were almost entirely cut off, owing to lack of shipping facilities, reducing our timber export to practically nil. The labor shortage throughout Canada also seriously affected the production and manufacture in all branches of the trade.

Now that the German U-boat has been removed from the seas, shipping will soon be returned to its normal condition, and the overseas demands for lumber should undoubtedly boom the Canadian lumbering trade. Before the war, Italy imported approximately $35,000,000 worth of lumber annually, which was about 85 per cent. of her total lumber requirements. In these imports, Austria-Hungary held first place, supplying, in 1913, the year preceding the war, approximately four-fifths of the total quantity.

During the last four years the Italian forests have been greatly exploited, approximately 50 per cent., it is stated, of the standing timber having now been cut. This over-cutting of the home forests has been necessitated by the stoppage of exports from Austria, and by the very costly and extremely difficult transportation of lumber from America and Scandinavia. Large quantities of lumber have been required for war purposes and, in the absence of coal, also for fuel.

It has been stated that, at a most conservative estimate, Italy will have to import at least double the quantity of lumber imported in pre-war years. This increase will be necessitated by general industrial activities, building operations, and the reconstruction of the invaded provinces.

Italy's situation is more or less typical of many of the European countries, and there is no doubt that Canadian lumber will find a ready market in Europe, provided that it can be transported by a service that will allow competitive prices.

We have an almost inexhaustible supply of lumber in Canada and given the market, the only problem to be confronted is that of labor supply. There is no doubt we are on the eve of the greatest labor problem Canada has ever been called upon to solve. The cessation of the manufacture of war munitions and the demobilization of our overseas military forces makes it necessary for us to find employment for hundreds of thousands of men. We can look to our forest areas to furnish employment for a large percentage of our war workers and our returned fighting men.

London Technical and Art School

THE recently completed technical and art school at London, Ont., is of reinforced concrete construction throughout. Like many of the more modern school buildings, it is practically all above ground. The only basement space is that required for the heating plant and the fans and necessary ventilation equipment.

As is shown in the accompanying illustration, the building is three stories in height and the window area will assure perfect lighting for the various class rooms. Steel sash is used throughout the building.

Trussed Concrete Steel Company's floor tile, as shown in our illustration, was used in the construction of all floors. The partitions, other than those of solid brick, are constructed of gypsum block. All of the corridors are floored with quarry tile, and a special feature of each corridor is the locker accommodation. Each pupil will be alloted an indivdual locker which is well ventilated by means of special flues carried through to a fan on the roof.

The equipment details have been given careful consideration. An example of this is the completely furnished model apartment laid out in conjunction with the domestic science classroom.

Every classroom is completely equipped with the standard equipment necessary for the particular branch of vocational training undertaken by each class.

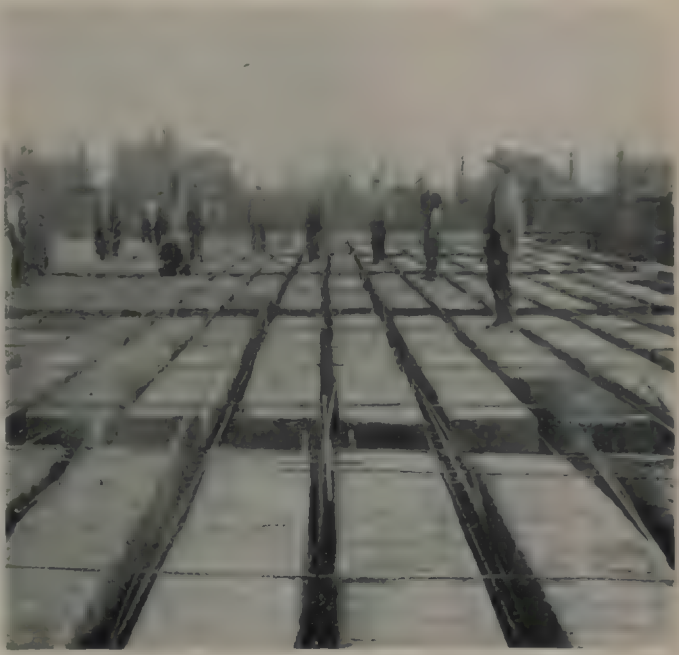
The construction work was standard throughout and furnished no unusual features.

As shown in our illustration, the elevation of the building presents an exceptionally pleasing appearance. The contrast, so striking in effect, secured by the use of a tapestry brick and the white stone trimmings, gives the building an individuality that is so much desired, but not always secured.

General View, London Technical School

At a time like the present, when considerably more attention is being given to techical education than ever before, London is very fortunate in being able to offer facilties to this class of students, seldom obtainable outside of our metropolitan cities. Many more of our cities would be well advised to seriously consider the example set by London.

The building was designed by Messrs. Watt & Blackwell, who also supervised the work of construction. Mr. John Putherbough was awarded the general contract and the sub-contracts were carried out by the following: Carpenter work, Samuel Willis; plastering, Geo. Gould; painting and glazing, Pace & Son; metal work, Wm. Stevely & Son; roofing, Walter Scott; plumbing and heating, Eggett & Co.; floor tile, Ital. Mosaic & Marble Co.; wiring, Benson & Wilcox; cut stone, A. & E. Nobbs; lighting fixtures, MacDonald & Willson; steel sash, Trussed Concrete Steel Co.



Form Work in Place for Placing Concrete Floors

The supply firms furnishing materials are as follows: Lockers and toilet partitions, Dennis Wire and Iron Co.; boilers, E. Leonard & Son; exterior face brick, Don Valley Brick Co.; steel, sash and reinforcing steel, Trussed Concrete Steel Co.

Influence of Salts on Concrete

Experiments made with four cements and eleven salts, namely chlorides, nitrates, sulphates, and bicarbonates, showed that the effect generally was to lower the tensile strength, and any increase, which was usually associated with sulphate, was very small. The cement with the highest content of calcium seemed to be affected the most. The sulphates and chlorides of zinc and copper caused a retardation in the initial set, which increased with the concentration.

Owing to the estimates exceeding the amount allocated to the construction of the storage dam at the outlet of Lake Jacques Cartier, sixty miles north of Quebec, for the Quebec Streams Commission, the bids recently sent in have been returned.

Keep the Main Roads Open in Winter

By Geo. H. Biles*

PENNSYLVANIA has a keen appreciation of the volume and character of present-day highway traffic and its demands, due to its important industrial position. We feel that it is but the beginning, and new methods, increased energy and study must be applied to meet these conditions.

Our State was put to the crucial test last winter in answering the call of the nation to keep the roads open. I dare say that few of us recall a more severe winter, and it augurs well for the future when such abnormal conditions can be successfully combated as was the case with our main arteries of traffic. The first steps taken to cope with the situation were to provide an organization to prosecute the task efficiently. This was but an enlargement of the regular force of maintenance employees. I might mention here that we have a colossal maintenance proposition in Pennsylvania in looking after the upkeep of over 10,000 miles of highways, approximately 65 per cent. of which are unimproved, and with a working force in some periods of the season of over 12,000 men, it must be granted modern business principles in organization and operation are essential.

The Division of Maintenance of the Department, composed of the assistant engineers, superintendents, foremen, caretakers, labor, etc., took complete charge of the snow removal work under the direct supervision of the Second Deputy Commissioner. From the inception of this division, in 1913, surveys and studies have been made of snow conditions and data compiled that has served, and will continue to serve, in good stead, for there are many points where it has been developed that the construction of snow fences is the most economic practice. Considerable of this snow fence has been constructed up to the present time and is ready to be put in place. At present prices this costs approximately 50 cents per running foot in place, and the design closely approximates the railroad standards.

Providing for Motor Convoy Traffic

Due to the war conditions, a new class of traffic had to be reckoned with in the United States motor convoys, the imperative nature of which justified some of the unusual measures taken. As an example, arrangements were made with the Western Bureau officials to wire forecasts of approaching storms to the central office at Harrisburg, which information was communicated immediately to the local forces. This afforded an opportunity to anticipate conditions and organize accordingly. The War Department also wired proposed convoy movements, whose schedule was followed closely from the time they reached the western limits of the State until they passed out toward the seaboard. Stations were established along the lines of the highways at the larger towns where motor truck equipment with snow plow attachments, road machines, drags, shovels, etc., were located. The caretakers or patrolmen, who were regularly employed on the road were used as a nucleus to create the forces to handle the work. Systems of reporting were devised through telephone, telegraph and mail, depending upon the conditions, to convey to the central office the exact status of the work at all times. This information upon receipt, was charted and made available at once, from which a bulletin was prepared.

It would appear that what is possible of accomplishment in Pennsylvania in this respect is true of most States, for the topographical conditions are such that energy and resourcefulness were taxed to the utmost in overcoming the elements. When one takes into consideration that a major portion of our State is mountainous and many sections are in altitudes of between two and three thousand feet, in which there are stretches of highways many miles in length where there is not a sign of habitation for refuge or shelter, being entirely at the mercy of the winter elements, it seems more providential and miraculous than the work of man that such abnormal conditions were so successfully overcome and traffic maintained. Aside from the dearth of labor that was felt over the whole country at this time, there were sections wherein it was impossible to get labor of any character, and the mountains and villages for miles around had to be scoured for hands, who were transported by sleigh to the site of the work. To these hardy mountaineers and men who were prompted by patriotic motives, great credit is due for the success of the work.

Prompt Action from First Appearance of Snow

Snow removal work from the experience of the speaker resolves itself into snow fighting from the time the first snow makes its appearance. Work begins when heavy falls come by breaking through a track with road drags or small "V"-shaped plows drawn by teams. These were followed by the road machines or motor trucks with the snow plow attachments. Turnouts were made at convenient intervals and as soon as possible thereafter the road opened to the desired width of from fourteen to eighteen feet, depending upon the traffic. On improved roads every effort is made to remove the snow within a few inches of the metal of the road in order that no opportunity is given the traffic to track. What snow remains that does not melt, is removed entirely.

I will qualify remarks just made by saying that these methods apply particularly to improved roads, for if traffic is permitted to track during periods of freezing and thawing on such highways the surface becomes affected to various degrees, depending on the type of the road. We have a number of miles of waterbound macadam roads with bituminous surface treatments on the main trunk lines, and in order to preserve them during such periods it is essential to distribute the traffic. On the unimproved roads the snow is not taken off entirely down to the surface, but several inches is allowed to remain for the travel to pack, and as it softens more snow is dragged from the sides, in order to keep the surface comparatively smooth at all times. Rolling of snow is done on the less important lines, but this has not been very satisfactory on the roads where there is much motor traffic, on account of the rough condition that results when the surface becomes cut up. The snow being rolled and wet from time to time with sleet and rain-storms, becomes almost as hard as ice. However, there are a number of roads where the travel is light and used mostly by horse-drawn vehicles, where this method will suffice.

---

* Second Deputy State Highway Commissioner, Pennsylvania, Before Conference on Snow Removal from Trunk Highways.

In the work just described, especial attention was given to the drainage and cuts were made through the banks of snow to the ditch lines at certain intervals where possible, and drains and culverts kept open and free from obstruction. This precautionary measure produced very good results, for when the snow passed away in the spring, the roads had come through the winter in better shape than they had any previous time, in spite of the fact that they were subjected to greater traffic and increased weight of loads.

Implements for Varying Conditions

The heavy drifted condition required especial treatment. Drifts were so deep and banks so high on either side of the road in some places that snow had to be shoveled and hauled out. Snow, up to twelve inches in depth, can be handled advantageously with road machines, and from twelve to thirty-six inches, if not too heavy, can be moved with motor trucks with plow attachments, with excellent results. The truck is run along the one side of the highway and back on the opposite side at the rate of about four miles per hour, and carries a small crew of men with shovels that are used when the snow piles up in front of the blade, which it will do, especially when the snow is wet. When there is a greater depth than three feet, a large "A" shaped plow is used. This implement, which is 30 inches high at the nose and 6 feet high and 16 feet wide at the back, with 20 feet legs, is held together with movable braces and drawn by a heavy tractor, and it has proven a very economical and effective device. The movable braces are provided for the purpose of permitting vehicles to pass during the operation, if necessary. The light tractors for this work do not hold the road and have been found unsatisfactory. Mechanical devices are preferable in the majority of cases, but if the drifting is a continuous performance in cuts, it resolves itself into a shoveling proposition.

To keep the roads open under conditions similar to last winter, it costs from $50.00 to $200.00 per mile, depending upon the location and other conditions.

In 1912, when our system of roads were taken over for maintenance, the Highway laws, with respect to keeping up the road, were not generally interpreted to mean that snow should be removed, for it was an uncommon thing for the local road officials, prior to this time, to open the drifts. In many places, the fences along the line of the highways were removed and the fields used until the snow passed away. If the thaws caused the fields to become soft, in which condition the traffic would do them considerable injury, some effort was made to make the roadway passable. This era quickly passed and with the changing and increased traffic, the demands became great for an open highway the year around. So, in 1913, this responsibility was assumed by the State Highway Department and practically all the main trunk lines were kept open from this time on. The records for the winter of 1917-18, which covered the period from December to March, show 22 snow storms varying in depth up to 16 in., with drifts ranging from 3 feet to 16 feet in depth, the general average being 4 to 6 feet.

I firmly believe that where statutes permit—and it they do not, the legislative bodies should pass enabling measures at once—snow removal should be no longer an optional matter with the road officials in charge of our highways; for when we consider the enormous winter traffic on some of our roads, argument is unnecessary. As an example, we have a case on record of one of our highways on which, when the temperature was down to 25 degrees below zero, from actual traffic census it was shown that over two thousand vehicles passed in twelve hours.

American Lime Association Reports War Restrictions Removed

ALL members of the American Lime Association were notified recently that restrictions upon the industry were being removed by the War Industries Board, and it may reasonably be expected that this will be interpreted to cover other essential materials as well as lime. Lime, it is true, was particularly free from restrictions which were placed upon so many building materials, but the universal restrictions tended to curtail the production at a rate parallel with all others. The War Industries Board, we understand, intends to retain some measure of its control over industry during the readjustment to peace conditions and it should be of great service to the building and allied trades.

At a recent meeting of the Lime Association it was agreed that an educational campaign for the more efficient use of lime in agriculture should be vigorously prosecuted, and we understand that this work will be started without delay, so that benefit may be derived during the coming winter and spring of 1919 liming period. With such a large field, we feel sure that all lime companies are bound to derive much benefit. It is interesting to note that during the war period, farmers were required to secure a certificate if they needed more than one ton of agricultural lime in a year. The use of hydrated lime in concrete, which has been discussed in the "Contract Record," is becoming more generally recognized. A new set of standard specifications, issued by the Bridge Department of the Tennessee Highway Commission, calls for 40 pounds of hydrated lime per cu. yd. to be used in all bridge concrete in the future. This specification bears the stamp of approval of the Office of Public Roads, Washington, D.C.

Scientific Research Institute for Italian Metallurgical Industry

The Societa Italiana Ernesto Breda, one of the largest plants in Italy for the manufacture of railway stock, machine tools and now engaged in the production of war material, is putting up in connection with its establishment at Sesto San Giovanni (Milan) a special building, which will cover 5,000 square metres of floor space, for scientific and technical research as it relates to the metallurgical industry. This institute under the auspices of the National Technical and Scientific Committee will be placed at the disposition of the Italian Metallurgical industry for its development. —Trade and Commerce Bulletin.

It is now reported that a national housing scheme, similar to that proposed in the United Kingdom, may be initiated as a reconstruction measure in Canada. The suggestion is made that a plan might be drafted in which the Dominion, provincial and municipal authorities might co-operate.

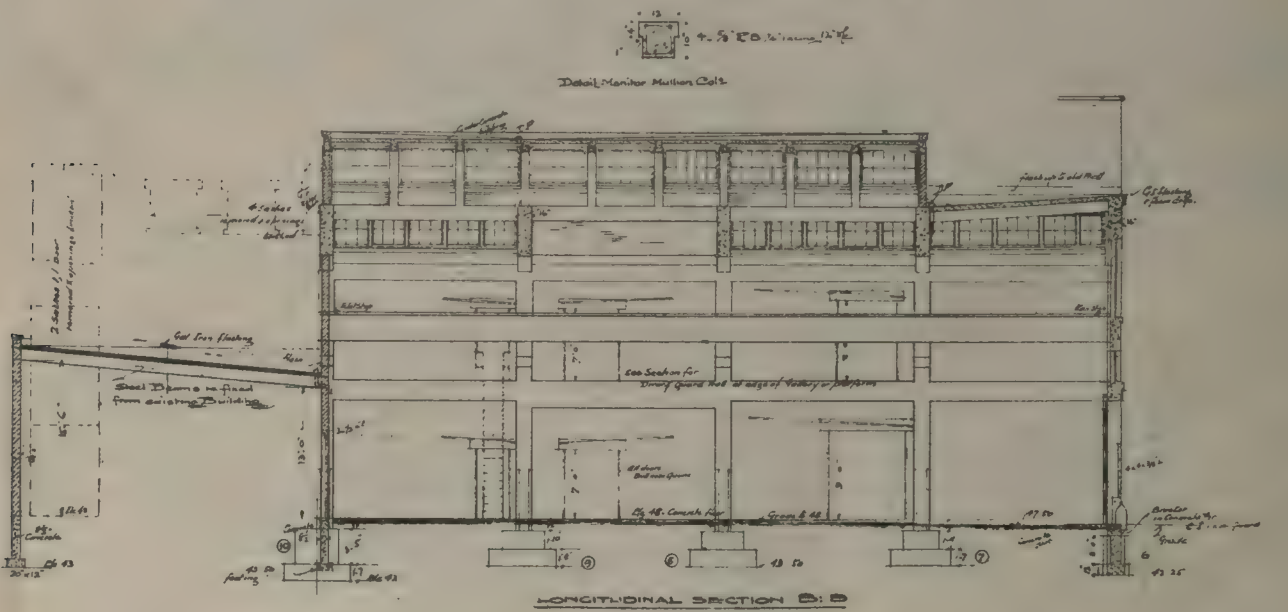
New Foundry Building of Darling Bros.

THE Foundation Company, Ltd., has just completed the construction of a new foundry for Darling Bros., Ltd., Montreal, from plans and under the supervision of T. Pringle & Son, Ltd., industrial engineers and architects, Montreal. and Toronto. The building is at the corner of Prince and Ottawa streets, immediately adjoining the firm's old premises and diagonally across the street from their offices and machine shop.

The foundry proper is 80 feet long and 96 ft. - 6 in. wide, with an adjoining roofed-in yard 31 feet by 96 feet 6 in. The foundry is of reinforced concrete throughout with brick curtain walls and steel sash. Special attention was given to the matter of lighting and ventilation, the window areas being of such extent as to make the interior practically as light as outdoors, as it was felt that under such conditions more accurate work could be turned out, as well as larger production secured. The subject of natural lighting is too often neglected in designing foundry buildings.

The central main aisle of the foundry is 35 feet wide, ventilated by monitors, and served by a five-ton electric travelling crane, running on a reinforced concrete runway. The side aisle along Prince Street is one storey high, and is also 35 feet wide. The other side aisle, in which is located the 5- ton cupola, is 26 ft., 6 in. wide and 2 storeys high. This aisle immediately adjoins Darling Bros'. old building and contains the charging floor elevator, the core benches and core ovens, with room and provision for another cupola. The elevator has a capacity of 3,000 lbs. and is fitted with a platform 5 ft. 6 in. x 8 ft.

The roof is of Barrett standard specification, with inside drainage.


Detail Monitor Mullion Col's
Gal Iron flashing
Steel Beams re-fixed from existing Building
See Section for
Dwarf Guard Wall at edge of Gallery or platform
All doors
Conc. floor
Grade
LONGITUDINAL SECTION B: B

Longitudinal Section of Darling Bros'. Foundry, Montreal

There are standard fire doors between the foundry and the old building and the foundry and the covered-in yard.

The building is heated on the Webster Vacuum system of steam heating, steam being taken through a reducing valve from a 40 h.p. return tubular boiler. The condensation is returned by means of a 5 x 6 x 10 vacuum pump discharging to a receiver, from whence it is returned to the boiler by a 5 x 3 x 6 boiler feed pump. Two thousand feet of direct radiation is installed, divided into 14 units capable of maintaining a temperature of 60 degs. during the severest weather.

Exterior View of Darling Bros.' Foundry

The core ovens are built of brick and are eqipped with the necessary shelves, core car, and lifting doors. The smaller ovens were supplied by the E. G. Woodison Co., Detroit, and are of the stationary type set in brick. The boxes are placed on swinging shelves which operate independently of each other, allowing for the removal of the cores without hindering the baking process on the other shelyes. The blower is of the Roots type, of 4,000 c. f. air minimum capacity, driven off the line shaft.

The patern making department has been enlarged and equipped with wood working machinery.

Construction of the building was carried out by contract and no difficulties were experienced beyond the universal shortage of labor during 1918.—Demolition of the old buildings on the site was commenced early in May and the work was virtually completed by the middle of August.

A noteworthy feature of the building is the careful working out of the flow of materials and adaptation of the design to future extension. All coke, scrap, pig-iron and sand come into the covered yard by Prince Street, being weighed at the entrance on a wagon scale. From there they pass through the foundry, and the finished castings cleaned and fettled in the adjoining old building, and shipped by way of Ottawa street.

The architectural iron was supplied by Mr. Fred A. McKay, Montreal; the steel sash by Steel & Radiation, Ltd.; while the roofing was sub-let to Douglas Bros., Montreal.

Two Important Sludge Problems

By Arthur J. Martin, M.Inst.C.E., F.R.San.I.

IT is the unexpected which always happens. A few short years ago the boldest prophet could hardly have ventured to predict that sludge, the bete noire of the sewage works manager, was destined to become an important factor in the purification of sewage. Truly the whirligig of time brings its revenges.

The new process, like every other method of purifying sewage, has brought with it problems of its own, not the least of which is that of utilizing to the best advantage the air upon which the purification depends, and the compression of which is by far the largest item in the cost of the process.

In all the experiments hitherto reported, the amount of air found to be necessary to effect a satisfactory purification has been far in excess of that required to oxidise the organic matter in the sewage. Thus at Worcester, with a sewage absorbing in four hours 2.1 parts of oxygen per 100,000, or 4.3 cubic in. per gallon, 0.8 cubic ft. of air, containing 288 cubic in. of oxygen, were used for each gallon of sewage. The stronger sewage of St. Albans, absorbing 16.2 parts of oxygen per 100,000 (33.2 cubic in. per gallon) required 2 cubic ft. of air, or 720 cubic in. of oxygen per gallon, being 21.7 times the theoretical quantity, as against 67 times at Worcester. Other experiments carried on elsewhere have yielded comparable results. Mr. F. W.Mohlman, for instance, in his thesis for the University of Illinois, printed in the University Bulletin for 1916, gives the results of his experience as follows: "In the presence of 25 per cent. of sludge, weak sewage was well nitrified in four hours with one cubic ft. of air per gallon of sewage. Normal sewage required four to five hours' aeration and 1.3 cubic ft. of air per gallon of sewage. Strong sewage required more than five hours' aeration and more than 1.5 cubic ft. of air per gallon of sewage," the correspondinging volumes of air per imperial gallon being 1.2 cubic ft., 1.56 cubic ft., and more than 1.8 cubic ft. for weak, normal and strong sewage respectively.

The large excess of air which is found to be necessary is due in part to the twofold duty which is thrown upon it. Over and above its own proper task of supplying the oxygen required for purification, it is called upon to perform an important mechanical function. It is essential to the success of the process that the three agents concerned in it—the sewage, the activated sludge and the air itself—should be intimately intermixed, and this is done by means of compressed air. At Sheffield, it is true, mechanical stirring is resorted to for the purpose; but in the large majority of cases the difficult task of maintaining the three reacting substances in close association is thrown upon the air, necessitating the use of many times the quantity which would suffice for oxidation.

A further reason for employing a large excess of air is the extreme shortness of the time during which it is in contact with the sewage. A deep tank gives a longer contact than a shallow one; but, if the air is allowed to rise freely, the period can at best be a few seconds. This period might, however, be prolonged to any desired extent by turning the contents of the tank upside down before the air has time to escape, which can readily be done by the use of a horziontal cylindrical tank, the contents of which are maintained in a state of rapid rotation, combined with a slow longitudinal flow. Such a tank might consist, for example, of two tubes side by side, each 3 ft. in diameter, and 100 ft. in length, with a united content of 8.836 gallons. The sewage, with its charge of activated sludge and air, would pass along one tube and return by the other, being then discharged or again circulated through the tubes as might be found best. The rotary motion of the sewage might be set up and maintained by means of jets of compressed air or of sewage injected tangentially, preferably the latter, as the amount of air required for the purpose would be considerable. If jets of sewage are used to effect the rotation, the air required for oxidation may be introduced through perforated pipes or porous tiles, or by any other means. If however, the tube is not quite filed with sewage, the top few inches being occupied by air the incoming jets and the subsequent rapid rotation of the liquid will doubtless entangle and drag down all the air which is necessary, thus obviating the need for compression and for the expensive machinery required for the purpose. Where the sewage is pumped, the delivery pipes might be so arranged as to set up the desired rotation, thus effecting the aeration of the sewage without any special machinery whatever.

It might in some cases be preferable to inject the compressed air at the lower end of the rising main, in which case special castings might be placed at intervals along the latter to quicken the rotary motion of the sewage.

The best rate of rotation can only be determined by actual trial. Within certain limits the higher the velocity the more intimate will be the admixture of the contents of the tube. Too rapid a rotation, however, would tend to separate them into concentric layers of sludge and sewage, surrounding a central core of air. This centrifugal effect would be counteracted to a certain extent by the tendency of the air to rise and that of the sludge to sink, and might be further combated if necessary by means of occasional jets of sewage impinging at such an angle as to set up eddy currents, which would break up the incipient layers without unduly checking the prevailing spiral motion.

The other problem is a much older one, and has baffled a whole generation of engineers. It is stated afresh by well-nigh every writer on the treatment of sewage. To quote one among the many recent references to it—Colonel Geo. G. Nasmith and Mr. G. P. Kay, of Toronto, begin their paper on the "Fertiliser Value of Sludge," in The Surveyor of August 30th last, as follows: "The important problem remaining to be solved in the disposal of sewage is probably that of dewatering the sludge."

The methods which have been used for this purpose have been many and divers—air drying, drying by heat, fermentation with yeast, filter pressing and draining on prepared beds. Yet another solution of the difficulty is suggested by some observations made by the present writer in connection with the septic tank laid down at Belleisle, Exeter, in 1896. In this tank the sludge was purposely left to accumulate for several years, and by December, 1900, it had reached a depth of about 4 ft. Samples were then taken from the top, the middle and the bottom of the deposit. These samples showed a water content of 88.8, 83.9 and 80 per cent. respectively, the percentage of water diminishing progressively from the surface to the bottom. There can be little doubt that the comparative dryness of the lower portion of the sludge was due to the squeezing out of the water by the weight of the superincumbent mass, each particle of which exercised on those below a partial pressure due to the difference between its own weight and that of the liquid which it displaced.

The observation above recorded has been confirmed by experience at several other works. A large proportion of the suspended matter which many tank effluents contain is derived from the sludge banked near the outlets, portions of which are periodically lifted to the surface by the gas generated therein. With a view to obtaining a tank effluent as free as possible from suspended matter, the writer has been in the habit of laying at the outlet ends of the floors of his tanks a pipe, having a slot extending the whole width of the tank, through which the sludge under the outlets for effluent might be forced out by the pressure of the sewage. Where these slotted pipes were regularly used, they worked freely, and the floors near the outlets were kept comparatively clean; but where, as not infrequently happened, they were neglected, the sludge accumulated, and often became so dense that when the valves were opened to draw it off, it would not budge.

At Andover, for instance, there were three tanks side by side, the cleansing pipes from all three being led into a valve chamber by the side of one of the outermost. These pipes were left for some considerable time unused. When at last the valves were opened, the sludge from the nearest tank flowed freely, but that from the others, which had several yards of pipe to pass through, absolutely refused to move. At length, by dint of rodding, the pipes were freed, and the sludge began to come out very slowly in a dense cylindrical core. The percentage of moisture was unfortunately not noted, but it was undoubtedly very low. At Andover, as at Exeter, the sludge was old and well mineralized, the loss on ignition in the latter case ranging from 27 to 31 per cent. of the dried solid. It would not as a rule be convenient to keep the sludge in the tanks so long, and a fresher sludge might not consolidate quite so readily, but any sludge which will settle at all must be heavier than water, and will therefore exert a partial pressure which, though small in a shallow layer, will in a deep column be very considerable.

These observations suggest that an appreciable proportion of the water contained in sludge may be best and most economically removed by running or pumping the sludge into a shaft of the necessary height, provided at the base with doors through which the compacted material may be forced out by the weight of the superincumbent mass. After a few days in such a shaft, the lower portion of any ordinary sludge should have parted with enough of its water to be readily handled with a spade. If for any reason it is desired to dry it still further, a platform for the purpose may be arranged at the base of the shaft.

The use of heat at this stage will probably not be economical, better results being obtained by blowing air through the sludge, whereby the process of air drying may be greatly accelerated.

While it is practically certain that the sludge obtained by any of the older processes can readily be reduced to a manageable condition by its own pressure, it is not so clear that this method will be applicable to activated sludge. Such a sludge is notoriously flocculent and contains a very large percentage of water. At the same time it is pointed out by Mr. J. E. Willcox, in his recent presidential address to the Association of Managers of Sewage Disposal Works, it "'settles with extreme radipidity." There is little doubt, therefore, that in a shaft of sufficient depth the partial pressure, even of an activated sludge, might be utilized to squeeze out a considerable part of its water contents. The pressure would, of course, be cumulative, each successive increase in the density of the material producing a corresponding increment in the pressure. Mr. Willcox himself goes on to suggest that "tank concentration might be found useful in order to reduce the quantity to be handled," and a shaft such as is now proposed is nothing but a very deep tank.

In consolidating an activated sludge it is important to avoid de-aeration, and to this end it might be necessary to blow in compressed air at the base of the shaft. The air on its upward way through the sludge will carry with it much of the water, especially if it is used hot from the compressor.

The writer puts forward these suggestions with some diffidence, but he is not without hope that they may point the way to the solution of two formidable problems.

British Reconstruction in Order of Importance

THE Council of the British Society of Architects, having been invited by the Building Materials Supply Committee of the Ministry of Reconstruction to submit its views on certain questions contained in a reference to the Committee regarding the supply of materials and labor, etc., and to make recommendations as to any measure of control, has offered a number of suggestions, including the following, with reference to priority building:

In the event of the supply of material or labor being insufficient to fulfil the total building demands during the transition period, the Council suggests the following order for priority and control to be exercised for the shortest possible time.

1. Work of national importance, such as buildings required to accelerate ship-building or for other urgent public services.

2. (a) Necessary buildings for essential industrial purposes.
   (b) Housing accommodation of a low rental value.
   (c) Reinstatement of premises damaged during the war.
   (d) Essential maintenance repairs.
3. Schools, sanatoria and similar work where urgently required in the interest of the public.

Note.—All other buildings to be considered on their merits and priority to be granted according to their national importance.

Method.—The Council strongly urges that if priority and control is instituted the following points should be most carefully considered by the committee:—

1. That all schemes for building work, whether for government departments or for industrial works, cottages and other classes of buildings, should come before one committee only, and that because certain building work may be carried out for or by a Government Department, such work should not on that account be given preference, but that it should also be decided entirely on the basis of national importance.

It is suggested that no Government Department or Local Authority should have power to commandeer any building material, but that the purchase of such material should be regulated according to the national importance of the work for which it is required.

Stimulating a More Active Interest in the Housing Problem

Mr. Thos. Adams, town planing advisor of the Commission of Conservation, recently addressed a meeting held in Toronto, under the auspices of the Great War Veterans' Association, with the object of stimulating a more active interest in the housing situation. Mr. Adams declared that any successful scheme to relieve the present acute conditions must have the full support of the Federal, provincial and municipal authorities. The failure of the municipalities in Ontario to take advantage of the provincial government's offer of a loan for housing purposes, he thought was perhaps due to the fact that municipal representatives, being elected for such short terms, fear they may antagonize the voters by piling up too high a tax rate, but it seemed to him they were making a mistake in not appointing men whose sole duty it would be to make a study of the particular requirements of each town or city.

To prove the acute need of providing more housing accommodation in Toronto, Mr. Adams gave figures showing how families had been obliged to double up, while many others had to be satisfied with homes not properly adapted to their needs. He emphasized the fact that housing cannot be separated from town planning, and pointed out that while conditions were bad enough in the down-town sections of all large cities, an even greater difficulty was the crop of shacks which sprang up on the outskirts, outside the jurisdiction of the municipality. This would be overcome by looking into the future and making conditions so desirable within the city limits that home-seekers would not wish to go outside.

With regard to the efforts of many big concerns to solve the problem of housing for their employees by undertaking industrial housing developments outside the cities. Mr. Adams said these schemes had also been found to have their disadvantages. In the United States the experience had been that shacktowns spring up on the outskirts of these model communities. However, he declared that manufacturers were bound to move out to the suburbs in increasing numbers, and though there were many problems to be faced due to land speculation, he believed their difficulties could be overcome if the Federal, provincial and municipal governments would get together and plan a workable system which would make it more attractive to build homes in the model communities than on the outskirts.

Mr. Adams also touched upon the question of tenement and apartment houses, which, he said, were the same thing under different names and discussed the suggestion that down-town buildings should be converted into apartments to relieve congestion. There were advantages to this scheme from some aspects, such as proximity to places of employment, but he declared that it would prove undesirable in the long run. The cost of converting a building into an apartment house would be double that of providing equal accommodation in the suburbs of the city, and there was also the further draw-back of higher rentals. It would be impossible to rent such apartments at the same rates as houses in the outskirts of the city, owing to higher assessments on the property, and there was the further danger of rapid depreciation of the property and the higher cost of upkeep. At best they would never be real homes for the workers and their families

The suggestion that house shortages could be met if organizations of workmen would club together and form societies for the collection of funds, from which the small builders could borrow money to build homes, was, in Mr. Adams' opinion, a workable one. This scheme had proved successful in other countries, and there was no reason why it should not do so here.

Mr. Adams pointed out, however, that house building for the future was not the only problem. It was necessary that each municipality enact legislation to improve the houses already existing. Measures might be taken similar to those applied in Great Britain, where municipalities have the power to order landlords to improve their homes, and failing compliance, the authorities may step in and make the required improvements at the landlord's expense. Here in Canada, the speaker said, the necessity for house-building was even greater than in Great Britain, owing to the greater increase in population caused by immigration.

Sir John Willison, who was present at the meeting, suggested that the Federal Government should take up the question by voting a sum of $10,000,000 at least, to provide proper housing in the Dominion. In his opinion, the responsibility rested on the large employers to see to the proper accommodation of their employees. He agreed with Mr. Adams that some municipal governments are reluctant to take up the problem, owing to the question of votes, and he thought that the medical officers of health should have power to order the improvement or the destruction of houses which do not comply with the laws of sanitation.

A resolution submitted by Sergt. Wm. Turley, of the Provincial G.W.V.A., calling upon all governments to take a greater interest in the problem, and to appoint men who will give the matter their full attention, was passed, and will be forwarded to the authorities concerned.

Some Readjustments

NOW that the war is ended we are faced with the problems of readjustments from war to peace conditions. Canada, in common with the belligerent world, will close her war equipment work in foundry and factory, and betake herself to the old-time avocations of a varied peace production.

The diversion will take time and will be accompanied by a longer or shorter period of partial employment, incident to the adaptation of machinery and labor to the new conditions. This will call for energetic and wise organization on the part of employers and for patience and good sense on the part of the employees. That these will be forthcoming there is no reason to doubt. Such co-operation has been apparent generally during the period of war in the production of material therefor, and is now even more necessary in the period of readjustment.

There are favoring as well as adverse factors and just now we should rather give emphasis to the former. A large body of skilled and partly skilled labor has been created by or trained in, the process of war production. A valuable experience has been gained in economic and effective organization on the part of capital which will be carried forward as an invaluable asset in the operations of peace production. Canada has learned valuable lessons in self-reliance, in power to overcome difficulties, and in faith in her ability and her resources. And the world's shelves are bare of the ordinary necessities and conveniences of life. A vast work of rebuilding and restoration confronts it. In this work Canada's resources and capital and skill will find abundant scope. All that is needed is the will to do and the ability to organize therefor.

In this work the Government will co-operate with the captains of industry and the forces of labor. But the industries must necssarily assume the greater share. They possess the machinery, the factories, the staffs and the practical experience. The ways and means are in their hands.

The Government can assist in obtaining outside markets in co-ordination and perfecting the facilities for transport and the mechanism of communication between foreign demands and the Canadian supply. Steps have already been taken in both preparation for peace production here and the provision of markets abroad.

Committees representative of all the great lines of production have been formed and are in close communication with the Government in Ottawa, whose immediate representatives will be the Ministers of Finance, of Trade and Commerce, the Minister of Labor, and the Vice-Chairman of the Reconstruction Committee. The War Trade Board, the Imperial Munitions Board and the War Purchasing Commission, all of which have during the war period been in close touch with Canadian productive industries, have been enlisted in conference and action. The Canadian Manufacturers' Association is working through its representatives on the general committee and its numerous sub-committees along all lines of industrial production.

Broadly speaking the efforts of the above outlined organizations will be: First, to plan for and carry out the diversion from war to peace production; and second, to organize for production in Canada destined to meet home wants and foreign demand.

Especially to assist the latter the Government has taken an advanced step in its policy of trade representation in extension of the regular and long-established methods. It has been decided to establish a Trade Mission in London as a central point, with extension in France, Belgium and Italy, which shall be representative of the general trade interests of Canada. The Mission will inform itself of the needs of governments, allied commissions, railway corporations, municipalities, reconstruction, relief, co-operative and other associations, and make itself the medium of communication between these and the producing interests in Canada with whom the Mission will co-operate in every possible way. Mr. Lloyd Harris, who has been head of the Canadian War Mission in Washington, will be transferred as chairman of the London Mission, and a thorough business organization will be set up under his direction.

While this will not preclude individuals and corporations from carrying on as usual, it will prove extremely useful in procuring big business along the lines of supplies needed by governments and for large reconstruction purposes. The organization in Canada will seek to work in touch with the Trade Mission for guaranteeing prompt and efficient provision of the needed commodities.—George E. Foster, Minister of Trade and Commerce.

Employment in the Building Trades as Indicated by Building Permits

Activity in the building trades, as indicated by the value of building permits issued in 35 cities, showed an increase during October, 1918, as compared with the previous month, the total value of building permits rising from $2,690,821, in September, to$2,850,428 in October, an increase of $159,607 or 5.93 per cent.

			October, 1918, compared with October, 1917 Increase (*) Decrease (†)	
City	October 1918	October 1917	Amount	Per Cent.
Nova Scotia	**$264,861**	**$101,903**	***$162,958**	*** 159.91**
Halifax	217,361	55,835	* 161,526	* 289.29
Sydney	47,500	46,068	* 1,432	* 3.11
New Brunswick	**26,636**	**180,350**	**† 164,716**	**† 86.79**
Moncton	8,535	174,250	† 165,715	† 95.10
St. John	17,100	6,100	* 11,000	* 180.33
Quebec	**615,242**	**475,233**	*** 40,009**	*** 8.42**
Montreal-Maisonneuve	379,150	313,533	* 65,617	* 20.93
Quebec	9,067	77,375	† 68,308	† 88.28
Sherbrooke	28,400	3,500	* 24,900	* 711.43
Three Rivers	93,875	75,700	* 18,175	* 24.01
Westmount	4,750	5,125	† 376	† 7.32
Ontario	**1,631,890**	**2,248,786**	**† 816,896**	**† 27.48**
Brantford	5,900	21,965	† 16,065	† 73.14
Fort William	2,400	8,900	† 6,500	† 73.03
Guelph	1,809	5,685	† 3,876	† 68.18
Hamilton	180,875	197,495	† 16,620	† 8.40
Kingston	35,033	18,132	* 16,901	* 93.21
Kitchener	15,275	15,275	......	......
London	277,650	143,460	* 134,190	* 93.54
Ottawa	205,078	93,625	* 111,453	* 119.09
Peterborough	37,117	817,875	† 780,758	† 95.46
Port Arthur	2,175	830	* 1,345	* 162.05
Stratford	5,460	4,529	* 931	* 20.56
St. Catharines	49,267	38,520	* 10,747	* 27.90
St. Thomas	2,120	2,820	† 700	† 24.82
Toronto	781,201	786,225	† 5,024	† .64
Windsor	30,530	93,450	† 62,920	† 67.33
Manitoba	**102,750**	**74,680**	*** 28,070**	*** 37.53**
Brandon	7,750	2,380	* 5,370	* 225.63
Winnipeg	95,000	72,300	* 22,700	* 31.39
Saskatchewan	**133,950**	**34,925**	*** 54,025**	*** 63.62**
Moose Jaw	76,370	4,650	* 71,720	*1,542.37
Regina	40,450	42,800	† 2,350	† 5.49
Saskatoon	22,130	37,475	† 15,345	† 40.95
Alberta	**32,200**	**212,500**	**† 180,300**	**† 81.32**
Calgary	76,000	132,000	† 56,000	† 42.42
Edmonton	6,200	80,500	† 74,300	† 92.30
British Columbia	**33,900**	**248,725**	**† 153,825**	**† 34.25**
New Westminster	7,500	4,600	* 2,900	* 63.04
Vancouver	70,825	233,975	† 163,150	† 69.73
Victoria	10,575	10,150	* 425	* 4.18
Total—35 cities	**$2,850,428**	**$3,627,102**	**† 776,574**	**† 21.41**

Progress, Prospects and Pitfalls of the New Profession of City Manager

By O. E. Carr, City Mgr. Springfield*

IT is now eight years since the city of Lockport, N. Y., became interested in the new form of government which she called the Lockport plan. But Lockport did not originate the plan, it came directly from the minds of men who were studying municipal matters. Briefly the plan of the theorists was:

1. To throw municipal government into a single elective body.

2. To place the number of commissioners at five, this being considered to constitute a workable and logical number designed to form the legislative body of the city.

3. To embody in the plan the principles of initiative and referendum and recall.

4. To arrange that a manager be appointed who should constitute the executive head of the city.

The Lockport Board of Trade sought to have the New York Legislature pass a bill enabling any third class city in the state to be governed by this form of government. The bill failed. It was in advance of the thought of the legislature. That was a short eight years ago. Such a law was passed in New York in 1914. Lockport business men are just now embarking on a second attempt to secure the city manager plan for Lockport.

Since we met last year a decisive year of the world's history has passed (never a year of such stupendous undertakings). Naturally it would tend to restrain small movements like that of changing the system of local governments.

But the movements of government are bound up in the world movement, material progress has not been so rapid but the idea itself has been immeasurably advanced by the great war. Last May our Secretary reported 123 cities committed to the city manager plan. Not a single charter city has yet gone back to a former plan of government. But best of all we chronicle a change in the attitude of the public mind towards the plan. When we last met rural communities were working upon it. It was considered a debatable question with much to be said upon both sides, but since the immersion of the country in the great war our national thought has been clarified and purified in the determination to succeed fully in the overthrow of our enemy. We have tried Committees, Boards and Groups. It was our usual way of working. But we were forced to discard them and to place the responsibility in a single executive head. Never has there been such an innovation in the government. One after another the great Boards that were to accomplish so much, were put in the discard. At present Ryan and Schwab, single executive heads in the air craft and ship-building, are accomplishing what we hoped to in the beginning.

We need argue no more, proof is before us, the public has been taught by heart breaking lessons, for this time we have the minds of the public at large turned towards the principles of the plan, at least without hostility.

But the thought of the public at large has changed no more than the thought of the managers themselves. We have come a long way from the atmosphere of our first meeting. Then we were men upon whose shoulders fell responsibility for good government and good morals, for development and proper growth, for settling immense problems for the city we served. We had, to put it mildly, a large sense of the community's need of us and of what we individually contributed to our various communities. None of us managers in those days were inclined to underrate ourselves. You remember that early feeling on the part of the citizens in which the majority of managers acquiesced was, that the manager was not only responsible for the administration of municipal matters but that he was also responsible for the direction of thought of his community and its activities in every line. In other words, that he was a sort of superman (many sided and versatile) the leader of his community and a man to be consulted in every venture. Now, of course, the manager as a public spirited citizen, is and should be interested in all things which make for the betterment of community life, but he has one duty—the administrative details of his city. He is not the only competent man in his community nor is he the only thinker. The most successful government is the one which is able to secure the most interested service from its citizens. Certainly the manager should not attempt to do all of the work pertaining to the growth of the city. I was aware that there have been different practices along this line. Some managers have been very loath to allow even a community activity like the Red Cross or War Chest to operate without themselves taking the reins by means of some high place. In every way possible they have sought to keep their hands on every activity in the city. Can we doubt that because they are mere men, and not at all super, that they have neglected duties essentially their own and they have dissipated their energies in directions which should be managed by other citizens? There is no doubt that logically speaking such a many sided manager might do real harm in the community. His activity in all public questions would result in a like passivity on the part of citizens trained and qualified for just such prominence.

An illustration to make this point clear. It is the duty of a manager to obtain the best service at a reasonable rate from a public service corporation. Suppose that he fails in his attempt to secure creditable service; then it is his duty to go before his commissioners and his public with facts and figures to prove to them concretely that the corporation is not rendering adequate service nor service equal to the amount of money expended for it. It is not his duty, as I see it, to agitate therefore for municipal ownership of such public utility. This should be left to the commission or should be taken up by the Chamber of Commerce or various city clubs. It is obvious since efficiently operated public utilities are their own best argument for municipal possession the manager should expend every energy towards giving service from those already possessed by the city since this is his direct duty.

By this attempt to standardize, in a measure, the duties of a manager we are attempting to increase his efficiency in the exercise of them. Our managers were men from other professions who carried to the new field no wealth of experience. They cannot do well the work for which they are directly responsible if they assume the direction of all activities within the city.

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*Before Fifth Annual City Manager Convention

If we have saved money, conserved health, contributed to the growth and well being of our community in large contrast to previous government, it is not due so much to our personal ability as it is to a form of government the principles of which are easy in operation and the responsibilities of which are definitely fixed thereby making success a natural consequence.

Prospects of Commission Manager Form

During the past year every effort of our citizens has been directed in various activities in connection with winning the great war. The drawing of municipal charters has for the most part been given up until our victory is finally won. But it must not be forgotten that those activities of war have trained a body of citizens in putting over public enterprises. Four-Minute-Men, Liberty Loan and War Chest workers are going to become interested in whatever is necessary in their communities. On account of the training they have received they are going to make short work of educating the public to new ideals of government. Moreover, as stated before, this public mind will have no difficulty in meeting the ideals of the commission manager plan. The march of the human mind is slow ordinarily, but there never was a time when the people at large will so accept the plans of a new government as now. There is positive pre-disposition towards it. Not in vain have been our great public failures in connection with our aircraft, shipping and ordnance boards. Not only does the public see that a single head is necessary for a department but it sees that that head must have had specialized training in the department and line which he heads. This lesson has cost us the lives of many of the boys we have lost on the other side.

The cities under the commission manager plan have moved along, adapting themselves to increased expenditure without increased revenues. Not one of them has gone back to the old charter form. In a very few of them old politicians have taken the public unawares and are back in power. I cannot prophesy just how that condition will end for even when politically administered the city manager plan shows good results simply because it fixes individual responsibility and there are many ways by which a public official in these days may be made to act. Altogether the future looks very bright for the Commission Manager plan.

Pitfalls or Obstacles in the Way of the New Profession

This part of the subject brings to my mind the query as to whether our work has as yet risen to the dignity of a profession. Can we say as yet that it is work which requires a specialized training? We are not even yet arrived at a point where we can settle the matter of suitable training absolutely definitely.

There is every indication that we have a new profession in city managership. At least a number of us have gained our experience in one place and have been promoted on account of our experience to others. But I do not believe that a City Manager will become a permanent fixture in his community, nor do I believe that it would be desirable except in very exceptional cases. Our school superintendents meet this same condition. We are practically agreed that our schools are benefitted greatly by an occasional exchange of executives. The infusion of fresh ideas, new plans and different methods in a community benefits it and keeps the ruts from forming. It will be so with the managers. A conscientious manager will be popular one month and unpopular the next. It is but a matter of time when he will have offended a considerable number of citizens by not seeing just their way in matters which if undertaken, would have benefitted each of them materially. The ungratified citizen becomes a publicity man against the manager and the harm he is able to do will be in proportion to the friends he has in the community. Therefore, the time will come in the history of each manager just as in the case of superintendents of schools when his best field for effort will be in a new locality.

Small communities are sometimes apt to think the salary asked by an experienced man is excessive, so they will select a young man who may or may not be good manager material, or a man who has served in various other political offices. Of course, I must discuss the matter as it appeals to me. Many professions have been called upon in the emergency to furnish managers. Some cities have sought the usual politicians. This is pitfall number one.

I can see why the engineering profession has been called upon so extensively to furnish managers. I can see why expert financial ability is an asset, why general publicity work might operate to advantage, why Chamber of Commerce men might do good work, but I will never be able to see why a perfectly good, honest plan of government should be prostituted by the appointment of a man accustomed to judge by political ideals. Human beings cannot help being products of their environment. Especially is this true of the moral senses. A politician will not administer government save as it makes for his own selfish ends. He cannot see further than that. Some of our cities which started right, have been manipulated so as to allow a politician to become a manager, thereby discrediting the plan.

A second danger lies in the mere human quality of managers. Power is a hard thing for a human being to stand. A manager must curb his tendency to high handedness, bull headedness or whatever name you may give the quality. Some prominent public officials have not been proof against this trait. I have no doubt that several managers have rendered their usefulness negative by just such a development. It has certainly caused some dismissals.

A third obstacle which is so insidious that it is dangerous is in the case where a manager has decided it is his duty to hold onto his job. His every official act is apt to fall in the line of least resistance—to attempt to give a good administration so far as it goes, to placate the angry, to flatter the important, to reserve decision where citizens might be rendered dissatisfied, to promise citizens favors which he knows can never be granted, in other words, to tread a safe path, conciliating, promising and half way rendering service to his city. He brings ill favor on a plan which is essentially good and at that his tenure of office has not warranted his plan of action.

But above all things the manager must remember that it is only his work to which he must devote his energies with patience, with thoroughness and with honesty and with perseverance—that he is only the administrative head of the city. He is naturally interested in government and if his aim to interest the public in both the aims and accomplishments of the administration.

The second class of pitfalls relating to the profession are those which grow out of relations with the commission. In the three cities I have served as manager, the commissioners of Springfield, O., are the only ones who themselves have accepted fully the principles of the city manager plan, who do not hasten to ascertain the political aspect of situations which present themselves. Though I have been fortunate in this respect, there have been men in every commission who were honestly trying to carry out the principles on which they were elected by the people.

I have served a city where the commission upon taking office desired to make a general housecleaning, of all officers whether they were protected by civil service or not. It was a condition where I counselled strongly waiting but where I finally acted because I realized that the commissioners knew the local condition where I did not. That one situation taught me a lesson. I had to bear the criticisms of the public when all these officials were re-instated by the courts. The commission did not come forward and advise that these wholesale dismissals were made by me at their request and in spite of my objections.

The third class of obstacles relating to the profession may be relegated to the people themselves. Some cities have adopted the city manager plan without any idea on the part of the mass of the citizens of what it really means or really stands for. They vote for it because they thought that nothing could be worse than what they had.

All Americans claim the right of an unmuzzled criticism of their public men. This right is made use of when it comes to the manager. If a manager is young they say—"what does that kid know about running a city—let him practice somewhere else." If he is older, "he is an old fogy and needs to wake up." If he is affable and friendly they say—"he tells too many people his business—he had better stick around the office and work." If he attends strictly to his business and is a quiet sort of chap then he is said to be unapproachable and gruff. It is pretty hard to please all of the people and popularity at best is of short duration. In all of our cities there is an element that belongs to the old political school. It is going to take many years before that influence is entirely gone. They do not intend to be pleased with the new plan and they busy themselves finding fault.

These are all small things but they are obstacles to the city manager plan, but I have faith, never so much as now—that managers are going to be able to work out their problems, that commissioners are getting better every year, that people are beginning to take a more intelligent interest in government and that they are ging to be tolerant of effort and more intolerant of inefficiency, that honesty is somehow going to be infused into the governmental conscience and that a favored class is in the process of elimination. For first, last and all of the time our basis of action must be in a free government as in ours, the greatest good to the greatest number.

Mr. W. A. Beddoe, Canadian Trade Commissioner to New Zealand, writing under date of October 11, from Auckland states "It would be advisable for Canadian manufacturers to answer correspondence promptly. There are so many cases which are brought to the notice of this office, where no notice is taken of letters.

Paints and Prevention of Corrosion of Iron Work

IN a paper presented before the Iron and Steel Institute, Prof. J. Newton Friend described his investigation for determining the broad general principles for the successful application of paint to iron for the prevention of atmospheric corrosion. Plates coated with various paint mixtures were exposed to the weather for periods varying from 5 months to 2½ years. The loss in weight due to corrosion was thus ascertained. His summary of the results of his tests follow:

The practical value of acceleration tests is very small in the present state of our knowledge. Reliable results can only be obtained from tests carried out under conditions closely resembling those prevailing in practice.

Addition of pigment paint to oil increases the efficiency of the latter as a protective paint until a maximum is reached. After this, further addition of pigment causes deterioration. The best results are obtainable from paints possessing as high a percentage of good oil as is compatible with good body and any other working property that has to be considered.

Linseed oil on setting expands by some 3.3 per cent. This is the primary cause of crinkling. Further oxidation causes a decrease in volume, which in time leads to cracking.

Linoxyn is permeable to moisture. The permeability is reduced by heating in absence of air, the oil increasing in density, viscosity, and molecular weight.

Polymerized linseed oil affords a better protection than raw oil when used as a paint vehicle.

A thick coat of paint protects the underlying metal more efficiently than a thin coat, provided the coat is not so thick that running or crinkling takes place.

The very best results are obtained by multiple coats. Two thin coats are better than one thick one of equal weight.—Engineering & Contracting.

Two Drafting Room Kinks

Erasing Fluid

Put all of the gum camphor in a two or three ounce bottle of grain alcohol that the alcohol will dissolve. The solution will remove ink lines, particularly those newly drawn, if applied to a piece of clean cloth and rubbed quickly over the ink lines on the tracing cloth until they disappear.

White Liquid for Drawing or Lettering on Blue Prints

Instead of using the usual caustic solution for corrections or revision of figures and such work on blueprints, I have had better success with Alba or Chinese white. The Chinese white is placed in a flat bottle, preferably with an opening between ⅜ in. and ¼ in., to permit a pen-holder being filled without touching the inside of the neck. A little water poured over the white and a drop or two of liquid glue or good paste added to the mixture will prevent the white from rubbing off the print when used. A few experiments will determine the proper amount of water to mix with the white to make dense lines and at the same time flow easily. About a dozen clean pieces of gravel almost as large as a pea, placed in the bottle with the white and water, after corking and shaking the bottle will mix the liquid quickly and thoroughly. This preparation does not eat nor blur and spread when used on blue prints, like caustic soda does after a few weeks. —"Concrete".

Canada's Heritage in St. Lawrence River

By Mr. Arthur V. White, M. E.*

THE Boundary Waters' Treaty of 1910, between Great Britain and the United States, under which the International Joint Commission was formed, now largely governs the development and use of boundary waters, and is of great importance in connection with the subject before us to-day because it constitutes the chief legal agency—so to speak—for safeguarding the interests of the people of both the United States and Canada in the international St. Lawrence River.

In proceeding, it will, I believe, be profitable first to point out how it is that even a recent treaty like the Boundary Waters' Treaty sometimes fails to provide that effective protection to either one country or the other, which it had confidently been expected would be found actual and full. I shall illustrate by reference to some issues which have arisen under the Treaty and to some arguments advanced under discussion of these issues.

Let me here comment, that the best safeguard the citizens of Canada can have in matters affecting their natural resources, is an intelligent understanding of the real value of their assets and of the best uses to which they may be applied, coupled with a quick and discerning appreciation of what constitutes any menace to these interests, and of how to act promptly for its removal. Menace to public interest often manifests itself in obscure and subtle forms.

Let us proceed to consider a few illustrations which, owing to limitations of time, can here only be referred to suggestively:

St. Croix River Application

The boundary line between the State of Maine and the Province of New Brunswick passes along the St. Croix River—a stream of considerable size. Four or five years ago United States financial interests controlling the St. Croix Paper Co. of the State of Maine, and operating in Canada through the Sprague's Falls Manufacturing Co., Limited—a company with a Canadian charter—undertook to increase the power installation which they already had upon the St. Croix River by erecting a new plant in the vicinity of what is known as the Grand Falls, situate about ten miles above Woodland, Me. The additional installation was to consist of 12,000 to 14,000 h.p., to develop which the company constructed a large canal lying and extending for nearly a mile entirely within the State of Maine. By means of a dam erected across the International Boundary at Grand Falls a lake was created so as to enable the water of the St. Croix River to be diverted by the canal into the United States for the development of power at the Grand Falls power house. This canal is so constructed that, at its lower stages, the total flow of the St. Croix River—an International Boundary stream—may be diverted into the United States. This company, after constructing their works, came before the International Joint Commission, pleaded ignorance of the law, drew special attention to their vested interests, and were finally granted a permit to utilize the works under terms greatly to their advantage.

Now, the Treaty provides that, after its acceptance, no diversion from boundary waters, whether "temporary or permanent," shall be made without obtaining the necessary authority. When the St. Croix case was under discussion, counsel suggested that the word "temporary" might not mean temporary with respect to time, but temporary with respect to place. That is to say, that the diversion of the St. Croix River was not out of accord with the treaty because the river was only diverted temporarily; that is, it was "temporarily" turned aside for a short distance and then resumed its normal course.

Navigation in Lake Michigan

Consider the next illustration: The Boundary Waters' Treaty defines boundary waters as "the waters from main shore to main shore of the lakes and rivers and connecting waterways, or the portions thereof, along which the International Boundary between the United States and the Dominion of Canada passes, including all bays, arms, and inlets thereof, etc." And the treaty also states: " It is further agreed that so long as this treaty shall remain in force, this same right of navigation shall extend to the waters of Lake Michigan and to all canals connecting boundary waters and now existing or which may hereafter be constructed on either side of the line."

Now, the treaty, subject to certain restrictions, stipulates "that the navigation of all navigable boundary waters shall forever continue free and open for the purpose of commerce to the inhabitants and to the ships, vessels and boats of both countries equally," and one not acquainted with possible interpretations suggested for portions of the treaty, is naturally surprised to learn that it has been contended that Lake Michigan is not a boundary water—although a geographically corresponding body of water in Canada, the Georgian Bay, is such—and the treaty suggests, inferentially, that Lake Michigan is only conditionally open to navigation, while Georgian Bay—the Bay is not specifically mentioned—is open, but not conditionally open as in the case of Lake Michigan. Besides, assuming that the uninviting project of the Georgian Bay Ship Canal ever materialized, this canal, under the treaty, would be as equally free and open to the United States as to Canada. Of course, I am not arguing one way or another upon the points cited in my illustration, and I am passing over any reference to rights still existent under earlier treaties. I am simply suggestively pointing out certain facts which have been disclosed, and indicating certain contentions which have been offered, when subjects involving treaty terms have, variously, been considered.

Water Diversion from Niagara River

Take another illustration: The Boundary Waters' Treaty, in Article V., deals specifically with the diversion of waters for power purposes from the Niagara River, and provides that "so long as this treaty shall remain in force, no diversion of the waters of Niagara River above the Falls from the natural course and stream thereof shall be permitted except for the purposes and to the extent hereinafter provided."

When, during the last few years, certain interests desired to utilize a portion of the waters now flowing in the lower Niagara River, that is to say, below the Falls, the claim was urged that such waters could be used without coming before the International Joint Commission for permission, because it was contended that the treaty only dealt with diversion of water above the Falls and did not specify where the water should be returned. In other words, some interests hold that, under Article V., the International Joint Commission has no jurisdiction to deal with any diversion in the Niagara River other than with diversion made from "above the Falls." The water, it was argued, could be taken out above the Falls and turned, if users so desired, directly into Lake Ontario without coursing the lower Niagara River.

Application of St. Lawrence River Power Company

While illustrations might be multiplied, we shall here consider only one other instance. This arose during the past

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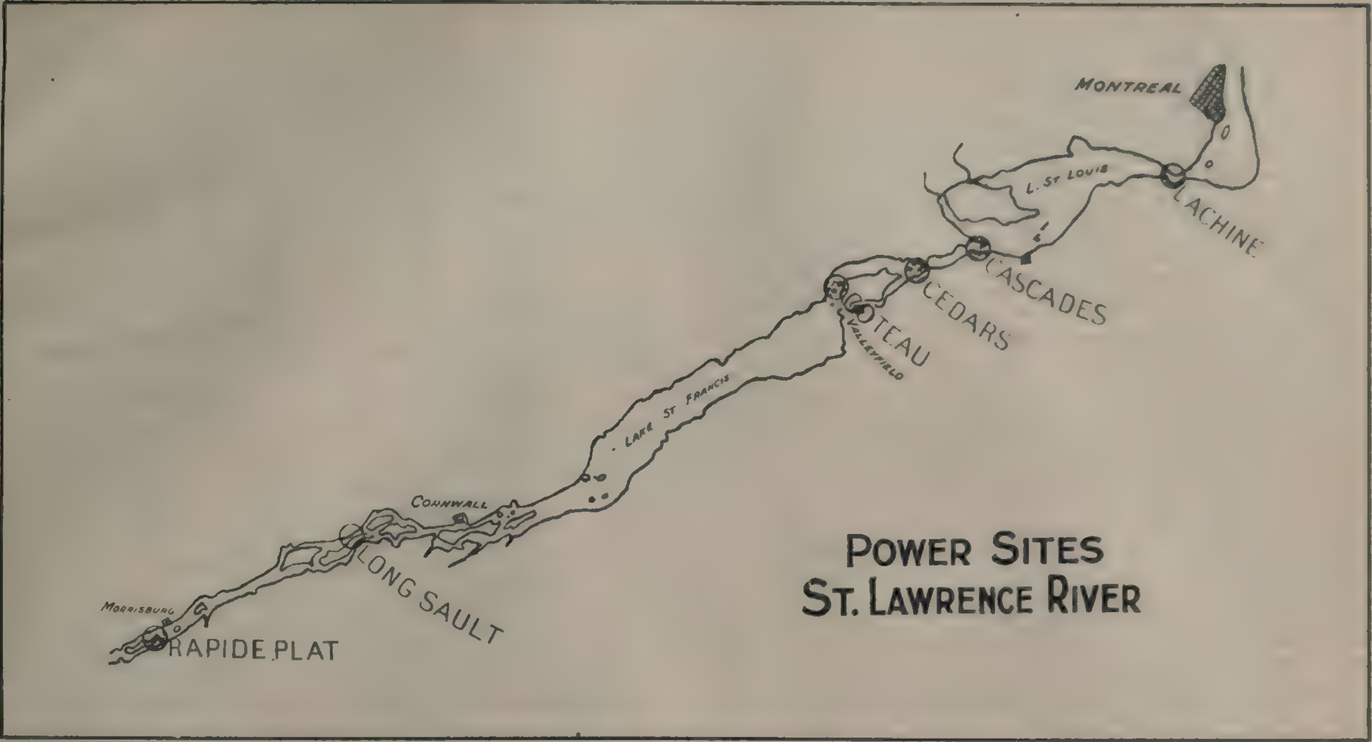
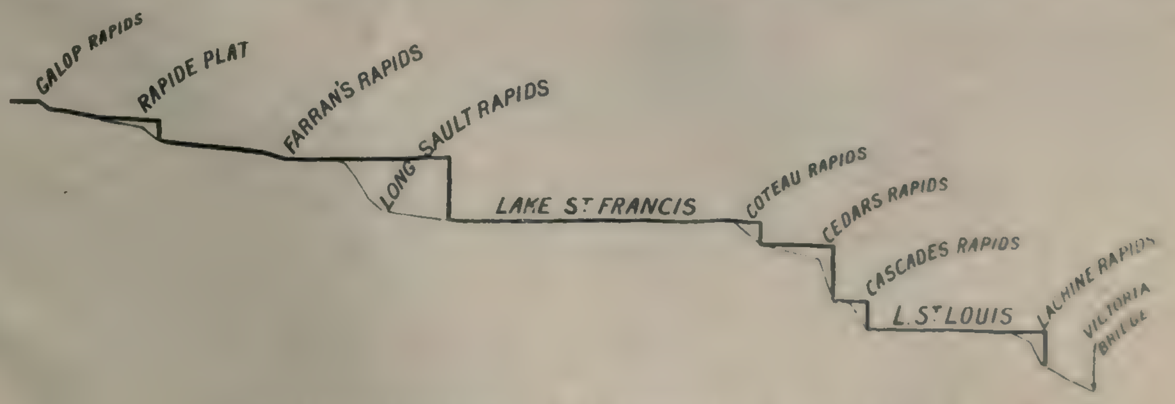
*Consulting Engineer, Commission of Conservation, Canada.



POWER SITES
ST. LAWRENCE RIVER

summer in connection with the application of the St. Lawrence River Power Company respecting the construction of works in the vicinity of, and the diversion of waters from, the Long Sault Rapids. The St. Lawrence River Power Company is a subsidiary company of the Aluminum Company of America, which, amongst other activities, operates a large aluminum-producing plant at Massena, N.Y. The St. Lawrence River Power Company desired to construct works in the St. Lawrence which would, so far as possible, remove ice difficulties which affected their winter output. To this end they excavated, largely in rock, a long channel, 25 feet deep by 150 feet wide, in the bed of the St. Lawrence River. Complementary to this excavation there was to be a large boom held by rock-filled cribs, some 30 feet square, sunk in the St. Lawrence River. Below the dredged channnel just referred to, there was also to be constructed in what is known as the South Sault Channel—that is, the passage nearest the United States' shore—a "submerged weir," which, actually, is a large submerged dam. The work of channel excavation was undertaken, and practically completed under permit from the United States War Department, without the matter in any way being brought to the official attention of the Canadian authorities.

The Boundary Waters' Treaty provides that there shall not be "any interference with or diversion from their natural channel of such waters on either side of the boundary" as will result in any injury on the other side of the boundary. If the enlarged channel remained, then the proposed submerged weir had to be constructed in order to compensate for alterations in level already resulting from the excavation. Incident to the construction of this weir the company deemed it desirable to obtain the approval of the International Joint Commission. Consequently, an application was made for hearing before the Commission. The company and the United States Government authorities stated that as a "war measure" it was necessary that the company be supplied with more power in order to produce more aluminum. The Commission was urged to deal with the application of the company without delay and to waive rules of procedure which constitute the usual safeguards so far as the public is concerned. This course was urged although the company knew at least about a year before it made the application that the



WATER-POWERS ST LAWRENCE RIVER

Approximate scales: Horizontal 1 inch = 20 miles. Vertical: 1 inch = 150 feet.

proposed dam would be necessary. Upon the war necessities Canada, of course, guaranteed every possible assistance and despatch.

In passing, I would like to remark that at times when certain issues have been under consideration before the International Joint Commission, and it appeared advantageous to interested parties to show how what might be done in boundary waters on one side of the boundary would affect the level of waters on the other side, it has sometimes been instanced that even a pile driven in a stream on one side would affect the level of water on the other. In the case of the large channel to which reference has just been made, which substantially affected levels in the river and adversely affected Canadian navigation, counsel for the applicant company argued that interests would really not be disadvantageously affected because when the large cribs and the dam was in place disturbed levels would then be restored.

Under the Webster-Ashburton Treaty it is specifically provided that the channels in the St. Lawrence River on both sides of Long Sault, Barnhart and Croil islands were to be kept "free and open to the ships, vessels and boats of both parties." So that, in any event, if the South Sault Channel were blocked by a dam, a navigable channel which was to be kept open by treaty right would be closed, and a public liberty and right which could not be justified under the spirit and intent of the treaty would be enjoyed by private interested parties.

Now, although the construction of the works referred to was, in the judgment of many, a violation of the spirit and terms of the treaty, the company, nevertheless, aided by their representations respecting the allies' war necessity, were able to obtain a permit to construct this dam and to have it remain in place for five years or for the term of the duration of the war, whichever term should be longer. You will notice it was not specified which term should be shorter. At the time of hearing before the International Joint Commission the solicitor-general of Canada, the Hon. Hugh Guthrie, on behalf of the Government of Canada made a special, solemn and very able protest against the granting of the permit except under conditions which he outlined, and which, while meeting temporary needs, would fully preserve the integrity of what he contended to be Canada's rights under the Webster-Ashburton Treaty.

From the foregoing illustrations it will be evident how necessary it is for our leading public men, especially those in Parliament, to have a good understanding of Canada's natural heritage in boundary waters and of means which must be taken properly to conserve this heritage for the benefit of her citizens.

Navigation of St. Lawrence River

We shall now consider, very briefly, some more concrete aspects of the subject which to-day has our chief attention: "Canada's heritage in the St. Lawrence River."

First, just a few words with respect to navigation. The St. Lawrence as the wonderful water highway from the Great Lakes to the sea has, as you know, been improved chiefly by the canal systems of the Government of Canada. The new Welland Canal is being constructed with locks of 30 feet draught. If it is to be used so that deep-draft, ocean-going vessels may go up to the head of navigation of the Great Lakes, then the St. Lawrence River in portions of its main channel will have to be canalized by means of a series of dams with suitable locks. If the river as a whole be canalized, obviously the water-power of the river would be most economically developed by having the dams necessary for the navigation improvement made adaptable also for the development of water-power. One fact is certain, and that is, that, in order to conserve the integrity of the St. Lawrence River so that it may suitably be canalized—when the time comes for such work—its integrity must not be compromised by permitting the erection of structures in the main stream for piecemeal development of power, although this has already been done to some extent. Naturally, there is a great temptation for water-power companies to do on the St. Lawrence as has been done elsewhere, namely, to make the cheapest possible preliminary developments—skim the cream off the powers, so to speak—for by so doing interests may readily acquire markets, and vested rights, and often control of the general situation.

I shall not further refer to Canada's heritage in the navigability of the St. Lawrence. In a word, it may be summed up that deep-craft navigation from the Great Lakes to the sea involves, absolutely, the treatment and canalization of the St. Lawrence River as a unit.

Water-Powers of St. Lawrence River

Coming next to the heritage of water-powers, I would remark first that the water-powers of the St. Lawrence River are, as yet, largely within the control of the people. The recent shortage of hydro-electric power which has been so keenly felt, both in Canada and the United States, has drawn increased attention to the enormously advantageous powers in and adjacent to International Boundary waters. Most of the water-powers which are more readily capable of economic development in Canada as well as in the United States either have already been developed or are privately controlled. Concentration of ownership is a noticeable feature of this control. Canada cannot afford to have her St. Lawrence River powers pass into the hands of powerful private interests.

Some Governing Factors

With respect to development of these water-powers, there are some very important points upon which I must just comment, such as ice conditions, the exportation of Canada's share of electrical energy and the character of the agencies utilizing the power.

Respecting Ice.—Power development on the St. Lawrence River cannot properly be considered apart from the subject of the ice menace. Too great caution cannot be exercised before attempting to harness natural forces of such magnitude as exist in the flow of the St. Lawrence River. Too radical a disturbance of the balance which Nature seeks to maintain may cause disaster, hence it is well to emphasize this phase of the problem, for it involves the weighing of basic physical factors of paramount importance.

Respecting character of consumption of power.—Where very large developments of power take place it is, as you know, usually necessary to have some industries, such as the electro-chemicals, take large blocks of power. These industries require cheap power. As the demand for power increases for municipal and small manufacturing purposes the experience has been that the demands for power for such uses become so urgent, and the inducements by way of price so attractive to the vendors of such power, that large industries which were attracted by the cheap power have been compelled to go farther afield. A block of power—over 65,000 h.p.—such as is exported from the Cedars plant in Quebec to the Aluminum Works at Massena, N.Y., would be sufficient, speaking on a broad basis, to supply light and power to some 35 manufacturing cities of 10,000 inhabitants each. It will be apparent from a comparison of the benefits resulting from power thus widely distributed and the localized benefits from the same power utilized in bulk, as in electro-chemical industries, that the former contributes in a much greater degree to the upbuilding of communities and to the growth of the country at large. This feature should not be lost sight of.

Respecting the Exportation of Electrical Energy.—There is strong opposition, especially throughout Ontario, to any policy which permits the exportation of electric energy really required for use in Canada. The Federal Government has been memorialized upon this subject. It has been urged that no large power projects such, for example, as those on the international portion of the St. Lawrence River, should be developed without reserving Canada's share of the power for use here; and, further, that powers situated wholly in Canada should be reserved against the day of Canada's need. This statement is made having in mind the fact that it is not the policy of Canada to embargo her exports, but that commodities of national importance should not be exported without an adequate **quid pro quo.**

On the St. Lawrence River below Lake Ontario the first site where development involving the whole flow of the river could be made is in the vicinity of Morrisburg. With a dam near the foot of Ogden Island, a head of about 11 feet could be obtained, or, by taking in a portion of the Galop rapid, it has been thought possible to obtain a total effective head of about 15 feet. It is at this Morrisburg site—the Rapide Plat—that the New York and Ontario Power Company develops power in a small plant at Waddington, N.Y., under rights extending back for one hundred years. This company desires to reconstruct this plant and increase the development, thereby providing power for disposal in the United States as well as in Eastern Ontario. The company offers to have this project made conformable to any scheme for the development of the river as a whole.

The next possible development is that at the Long Sault Rapids, where the possible head is variously estimated to be about 35 to 40 feet. This is the site near Cornwall, where the Long Sault Development Company, a subsidiary of the Aluminum Company of America, intended to erect its dams had not their charter rights been cancelled by the State of New York—a cancellation which was confirmed by the Supreme Court of the United States.

Descending the river, we have next, in a stretch of about 14 miles between Lakes St. Francis and St. Louis, three series of rapids: the Coteau, the Cedars, the Split Rock and Cascades. The Coteau site is the one for which the Power Development Company, Limited, has been seeking rights. Of this company the "Montreal Star" states:

> "There was incorporated, by letters patent a modest company, with a capital of $500,000, the incorporators being the bookkeepers of a well-known law firm in Montreal, closely associated with certain existing companies. . . . . A modest notice appeared in an obscure newspaper with a small circulation . . . . . and there was quietly filed a declaration in the Registry Offices of the counties where the proposed development is to be made, indicating that no less a scheme is on foot than the building of a dam across the St. Lawrence River."

Reliable assurances, however, have been given that rights for this development cannot be obtained without full public notice and discussion when all interested parties will have the opportunity of being heard.

The Cedars Rapids Manufacturing and Power Company utilize at Cedars rapid a head of about 32 feet developed by means of a diversion canal some two miles long. The power house has been designed for an ultimate development of 180,000 h.p. This company exports some 65,000 h.p. to Massena, N.Y.

The Soulanges plant of the Civic Investment and Industrial Company is situated a short distance below the Cedars plant. Power is obtained by tapping the Soulanges canal. The head is 50 feet.

The St. Timothee plant of the Canadian Light & Power Company is on the south side of the St. Lawrence directly opposite the two last mentioned developments. The water is led through a portion of the old Beauharnois canal. The head is 50 feet, and the development has an ultimate capacity of about 75,000 h.p.

I shall omit description of some other smaller plants, such as those at Mille Roche and in the vicinity of Morrisburg.

To summarize, we may place the estimated low-water power of the international portion of the River St. Lawrence at about 800,000 h.p., of which Canada is entitled to one half, or 400,000 h.p. The potential low-water power on the portion of the river which lies wholly within Canada would be 1,400,000 h.p. This, with its share of power along the International Boundary, makes an estimated total for Canada of 1,800,000 low-water continuous horse-power. It is detailed in the following table.

Water-Power on the St. Lawrence River*

(Tentative schedule)

Site	Head available	Estimated low water 24 hr. h.p.	Average estimated 24 hr. low-water h.p.
Morrisburg Rapide Plat	11-15	170,000-230,000	200,000
Long Sault rapid	30-40	500,000-650,000	575,000
Coteau rapid	15-17	230,000-270,000	250,000
Cedars rapid†	30-32	490,000-515,000	500,000
Split Rock and Cascades rapids ...	14-18	220,000-280,000	250,000
Lachine Rapid	20-30	300,000-450,000	375,000
Total	.....	1,910,000-2,395,000	2,150,000

*In this table, to have the estimates fairly representative of the possible quantities which might be expected under representative low water flow conditions, some allowances have been made for efficiency and other factors.

†Under development for about one-third of the low-water flow of the river. Consideration would be given to the possibility of combining the Coteau, Cedars, Split Rock and Cascades; also of increasing the Lachine power.

The above estimate, excluding ice conditions, is conservative. Under a "diversity load factor," such as is experienced by the Hydro-electric Power Commission of Ontario, Canada's 1,800,000 h.p. would take care of a power demand of some 2,400,000 h.p.

Canada's share of this power belongs respectively to the provinces of Ontario and Quebec. The Federal Government has the rights in and jurisdiction over navigation. When the time comes for international questions in connection with the development of this river to be adjusted to admit of proper development, there is no doubt that the various interests involved, whether federal, provincial, corporate or private, will, respectively, be fully taken care of. Perhaps, for example, some arrangement may be made by which the Federal Governments shall provide the dams for navigation purposes, making available for each province its share of water-power under an arrangement by which the provinces would assume such financial and other responsibilities as were purely incident to the power assets.

I trust I have adequately emphasized the absolute necessity for statesmanlike dealing with our resources of boundary waters, the wise conservation, utilization and administration of which will help build up Canada and pay our future taxes.

Mr. Frank M. Preston, the recently appointed city engineer of Victoria, B.C., was born in England thirty-seven years ago, having emigrated to this country in 1911, when he was appointed assistant engineer for sewers and special work at New Westminster. In 1915 he joined the engineering staff of the city of Victoria as designing engineer to the construction department. For two years he was engaged on the design and construction of the North-West sewer in that city, and he contributed an article covering this work to the Contract Record. In 1915 he was appointed engineer in charge of sewers and bridges, and later, assistant city engineer. Following Mr. Rust's resignation as city engineer last September, Mr. Preston was appointed acting head of the department. He is an associate member of the Institution of Civil Engineers and of the Engineering Institute of Canada, also a fellow of the Geological Society of England.

Ducane, Dutcher & Company, consulting engineers, Vancouver, B.C., have changed the name of their firm to the General Engineering Company.

Mainly Constructional

East and West—From Coast to Coast

The Harbour Lumber Company, Limited, has been incorporated with a capital of $75,000, head office at Vancouver, B.C.

The King Street Association, Toronto, is agitating to have a new street opened up from King street to Front street, to provide adequate facilities for traffic to and from the new Union Depot.

Angers Metal Works, Limited, have taken out letters patent of incorporation, with a capital stock of $20,000, headquarters at Montreal, Que.

D. C. Burpee & Son, of Devon, N.B., have been awarded the contract for the Renous River Mouth bridge, the price being approximately $29,000.

The Ru-ber-oid Felt Mfg. Co., Limited, has been incorporated with a capital of $200,000, head office at Montreal. The company is authorized to manufacture and deal in roofing, flooring, paints, varnishes, papers, fabrics or felt, paper and canvas of every description.

Building permits to the value of $29,515 were issued in Waterloo, Ont., during the month of October, as compared with $15,275 in the same month last year. The total for the first ten months of this year is $234,397, as against $193,587 for the corresponding period in 1917.

The prize for the best essay on the solution of the housing question, submitted to the Ontario Housing Committee, has been awarded to Mr. Albert H. Leake, and a second special prize is given to Mrs. James Elgin Wetherell. There were 37 essays, in all, presented for consideration.

The contractor, Mr. Mills, who carried out work on a building for the Continental Bag Company in Ottawa, has been given a judgment of $395 by the Divisional Court, against that company. He claimed that boulders which he encountered in the excavation work, ranging from 1,700 to 7,500 pounds in weight, should be considered as "rock," and demanded extra compensation on that account.

Work on the Welland Canal will be continued as soon as conditions permit, and further work on the St. Charles River at Quebec is also to be considered shortly. Other proposals in view are: Dredging at Fort William and in the Fraser River, B.C.; deepening of the St. Lawrence Canal, continuation of harbor works at St. John and on the Halifax terminals.

The International Association of Machinists at their recent provincial convention discussed the matter of reducing the number of working hours in order to take care of any surplus of labor that may result from the cessation of hostilities. It was decided that some action should be taken along this line to prevent unemployment, and an eight-hour day was suggested for Ontario. Provision is also to be made for a further reduction in hours in case the trade depression becomes more marked than is at present foreseen. The carpenters are also taking up this question with a view to similar action.

At a general meeting of the council of the Canadian Manufacturers' Association held recently in Montreal, which was attended by many leading manufacturers from all over Canada, it was decided to ask the Dominion Government to take active steps in the work of reconstruction and to make a grant of not less than $1,000,000 a year for research work, by which to bring about new developments of Canadian trade. It was further decided to represent to the Government that no increase in export trade would be possible unless sufficient vessels were provided to take care of such trade, and it will be recommended that strong action be taken to aid in the construction of sufficient shipping to see that Canada's foreign trade is taken care of.

The annual meeting of the Toronto Housing Company was recently held. Due to arrested development and high cost of coal, labor and materials, the company's operations again showed a net loss, amounting to $3,980, without allowing for any dividend on stock. The management were hopeful that the period of net losses was at an end. The directors appointed for the coming year are: Mrs. H. D. Warren, Mrs. S. K. Currie, Mrs. H. S. Strathy, Mrs. A. M. Huestis, Mr. Thos. Roden, Rev. Peter Bryce, Mr. P. H. Mitchell, Mr. G. Frank Beer, Mr. A. M. Ivey, Mr. Thomas Findley, Lieut.-Col. Vincent Massey, Mr. Alfred S. Rogers, Mr. Alex. Auld, Mr. Geo. H. Gooderham, Mr. Frank Wood, Ald. Gibbons Ald. Hiltz and Ald. Sykes.

Personals

Flight Lieut. G. D. McLeod, architect, son of the late Professor C. H. McLeod, is among the first Canadian officers to be released from Germany. He was taken prisoner in Italy several months ago by the Austrians.

Capt. Raymond Rice Knight, former city engineer of Fort William, Ont., has joined the engineering staff of the Canadian Incinerator Co., Ltd., and is temporarily located at the Detroit office of that concern.

Mr. C. Hayward, who was previously on the staff of Morris Knowles, Ltd., Windsor, Ont., is now taking up work with Mr. Frank Barber, Toronto. Mr. Hayward is a graduate of the Faculty of Applied Science & Engineering, University of Toronto.

Messrs. R. S. & W. S. Lee, consulting engineers, Montreal, have submitted a report to the Kipawa Fibre Co., Ltd., on a water and a sewerage system for the Kipawa townsite, Lake Temiskaming. This is in connection with a proposed town planning system.

Mr. R. Del French, of Arthur Surveyer & Co., consulting engineers, Montreal, and Mr. E. Stansfield, Mines Department, Ottawa, are now visiting a number of briquetting plants in the United States in connection with the proposal of the Canadian Government to utilize the immense deposits of lignite in Canada.

Mr. James Powell, chief draughtsman of the motive power department of the Grand Trunk Railway, has retired under the superannuation fund of the company, after 36 years' service in the draughting department. He is succeeded by Mr. W. A. Booth, former assistant chief draughtsman of the motive power department. Mr. Powell is widely known as the secretary of the Canadian Railway Club.

Mr. W. J. Hyman has been appointed chief draughtsman of the car department of the Grand Trunk Railway in succession to Mr. K. F. Nystrom.

Obituary

Mr. T. Aird Murray, consulting engineer, of Toronto, who died three weeks ago in the Grey Nuns Hospital, Regina, Sask., as a result of an attack of influenza, was well known in engineering and municipal circles, in connection with his work on filtration, sewage disposal and sewerage schemes. Mr. Murray was born in the year 1866, in Dumfries, Scotland, and came to this country in 1908, shortly afterwards entering the firm of Macallum, Murray & McAllister. In 1911 he was appointed consulting engineer to the Saskatchewan Board of Health, and about the same time started a consulting practice on his own account. He was one of the promoters and a past vice-president of the Canadian Health Association, and was a member of the Engineering Institute and the Engineers' Club of Toronto. Mr. Murray was on a trip west to confer with the Saskatchewan Government with reference to sanitary matters, when he was fatally infected with the epidemic.

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The Immediate Future As Regards Labor, Supplies and Demand for Both

With the ending of the war the question everyone is asking is—What of the future? Are we in for a period of depression or may we expect a continuation of our activity and prosperity of the last three years?

The answer to these questions has taken various forms, depending largely upon the constitutional characteristics of the individual. The chronic pessimist sees nothing but blue ruin and unemployment; the optimist, nothing but shoals of money and tremendous business expansion. Between these two we may perhaps do well to steer a middle course. In any case the conservative estimate is likely to be the most accurate whatever the future may have in store for us.

However, there are many circumstances which appear to be determinable within narrow limits and a discussion of these will go a long way towards preventing extreme conclusions either way. As regards building and construction activities in general, with which, of course, our readers are most concerned, there are a number of facts which we may take as the basis of argument, and form individual conclusions, depending upon how these facts appeal to us as having more or less important bearing.

Generally speaking the discussion may be said to fall under three headings. There is, (1), the supply of labor, (2), the supply of materials, and, (3), the demand for both labor and materials—in other words, the amount of construction work available. These three items are, of course, so intimately associated that either one of the three may be said to control the whole situation. Let us look at the facts under each of these headings separately.

(1) Supply of Labor

Any overplus of labor can come from only two sources—munition workers, (directly or indirectly), and the overseas soldiers. Munition orders are being cancelled rapidly and it is probable that anything up to 100,000 workers, according to the latest reports, will have been released before Christmas. But a large proportion of these are women—say 25 per cent.—which leaves 75,000 male workers to re-establish themselves in peace industries. The women, without doubt, if they care to return to domestic work, will find plenty of it awaiting them.

The supply from overseas is not so easy to gauge. It is understood that Canadian soldiers will be free, for the most part, to return to Canada as soon as they want to. But we must count on a large percentage electing to stay and help re-build Belgium and France. This work will call for both engineers and unskilled labor and, considering the reputation Canadians have gained in Europe for doing things, it is reasonable to suppose their services will be in great demand for reconstruction work. Everything considered, it is doubtful if more than half the Canadian contingent will return at once to Canada to compete in the unskilled labor market—200,000 men is the outside limit.

This would mean a total of 275,000 men gradually available for construction work. If, as has been said, 100,000 men are anxious to go on farms the available supply is reduced to 175,000. In case of an active demand developing for our manufactured products, it is difficult to say how many of this latter number would be absorbed by factories, foundries, etc.

Plainly then there is no alarming evidence of the likelihood of widespread unemployment. One of the difficulties in the way of re-employment of our now semi-skilled war workers will be the wage question. They will demand the wage of the skilled workman. Where then is the unskilled labor to come from?

2. The Supply of Materials

On this point there is little doubt. With the exception of structural steel, Canadians, in the main, are in a position to supply their own needs and confidence is expressed on every hand that there will be ample materials to go round. Transportation may temporarily be an adverse factor but building materials are, generally speaking, supplied locally, and represent short hauls. It is known too, that the Canadian Government has large orders of rolling stock placed several months ago and now being delivered, it is said, at the average rate of 40 cars a day. By next spring, at the latest, our freight blockade should be a thing of the past.

In connection with the supply of structural steel referred to above, it may be mentioned that a report was recently circulated to the effect that the United

States mills were under contract to give continental orders precedence and that Canada may have to go short for some time. This is denied, however, and the way seems clear for an ample and immediate supply.

(3) The Demand for Labor and Materials

Building and construction work of various kinds is under discussion by practically every town, city, and municipality in Canada. There is no dearth of projected work. The only question is whether it is better to go ahead at once or wait in the hope of lower prices in both labor and materials. The Contract Record, some days ago, sent a questionnaire to some two hundred and fifty cities, towns, municipalities, and government departments and, though the replies are yet far from complete, enough information has been gathered to bear out the above statement. In the vast majority of cases discussions are still under way as a result of the ending of the war taking authorities unawares, so to speak, but from fourteen cities and towns whose programmes are already practically completed we get the tidy little sum of $5,948,000 worth of work projected for 1919. With one or two exceptions this applies to the larger towns and smaller cities of Ontario, the answers to the more distant centres not yet having come to hand, and the only large cities included in this list being London and Ottawa. If fourteen towns and small cities, taken at random, can produce a programme of these dimensions it is reasonably certain the whole of the municipal work in towns and small cities alone in Canada may easily run into very big figures, perhaps $50,000,000.

And these amounts, even in total, are comparatively insignificant when compared with the possibilities of cities like Toronto and Montreal and of big Government works. An estimate recently quoted for Toronto alone was $50,000,000, which seems easily possible when one considers such projects as the Harbor Commission's programme, the T. Eaton Company's buildings, the Union Station and the C.P.R. terminals at Leaside. Then there is the Welland Canal work, the Chippewa development by the Hydro-electric Power Commission of Ontario. Outside the province of Ontario one thinks of Halifax, with its Government Harbor and the reconstruction of the city as the biggest individual work, but there are legion enterprises only less important by comparison which, in the aggregate, total up to appalling figures. And, finally, come "good roads" for which the campaign of education of recent years appears to have paved the way for the annual expenditure of many millions.

Summing up, the situation seems to be, (1) unlimited construction work in project, (2), ample supply of materials, and (3) fair immediate supply of labor, with conditions improving during the summer of 1919. There is indeed a possibility of temporary unemployment due to the severe winter weather which will hold back construction work more or less, but this is a matter of three or four months at the most. This should, however, tend to bring the price of labor down to something approaching normal which, in its turn, will react in favor of earlier commencement of much work that at present is in the balance.

The Dominion government has already gone on record as being prepared to institute such work as is necessary to care for all unemployment. In reply to our inquiry in this regard we have the following very satisfactory letter from Hon. F. B. Carvell, Minister of Public Works:

Ottawa, Nov.. 23, 1918.

Editor, Contract Record.

In reply to yours of the 20th instant, I am very sorry that I am not in a position to give you even an approximate estimate of the moneys which this department is proposing to expend during the next year, as, on account of the multiplicity of business since the armistice was signed, we have not been able to even make an estimate, and, moreover, the government, as such, has not declared any particular line of policy. However, it is our intention to expend money in fairly large quantities in the construction of works which will employ labor, the primary object of the expenditure of the money being to provide employment during the reconstruction period.

I think, however, you may take it for granted that the appropriation will be on a fairly liberal scale, and yet I also hope there will be no misunderstanding about the character of the works to be constructed, because it is not my intention to fritter money away on works which are of no economic value after being constructed merely for the purpose of finding employment for laboring men. We can find quite sufficient works of a real public nature to absorb all the money which we will have at our disposal.

(Signed) F. B. Carvell.
Minister of Public Works.

Though Mr. Carvell states definitely that the Government is ready to care for all unemployment he also makes it abundantly clear that he has no intention of encroaching on the labor market at the expense of the provinces, municipalities or private enterprises. He proposes, in effect, to take care of merely the overflow. This is important, as it will mean that the Government will not be a party to maintaining the present abnormally high rate of wages. Indeed it would not be surprising if they fixed a rate of payment both as regards labor and supplies, and especially the former, somewhat below the standard ruling in the open market — that is, putting themselves in the position of saying: "If you really want work here it is. If you can do better, go to it." This course will be at the same time fair to the worker and sufficiently uncompetitive to encourage private enterprise of every sort. We have Mr. Carvell's word, too, that the work he is going to initiate is of a permanent character—no frittering money away. We believe the country has sufficient confidence in the Minister's independence of thought and action to accept this statement at face value, and give him the fullest support.

Everything considered, the immediate future of Canada's building industries looks very encouraging. The last four years have taught us our powers of organization, our resources and our resourcefulness, our ability to meet other nations on a competitive basis, our creative instinct, our powers of endurance—all summed up in General Currie's works: "They never attempted an objective they did not reach." If this knowledge of our own power is utilized in developing our magnificent country—and it will be—who can estimate or over-rate our progress of the next ten years ?

R. A. I. Annual Assembly

Notice is issued that the Royal Architectural Institute of Canada will hold its general annual assembly in Montreal on January 17 and 18, at the same time as the annual convention of the Province of Quebec Association of Architects. The program will be sent to all members of the Institute next month.

Progress on Concrete Dam at Paris, Ont.

WORK on the new dam at Paris, Ont., for the Grand River Race Co., is rapidly progressing. About 1,500 cubic yards of concrete has been placed, which is about 50 per cent. of that required for the job.

In a previous article in our issue of Sept. 11, 1918, covering the preliminary work on this contract, we outlined the many unusual features in the design of the dam and commented on the possible construction difficulties likely to be encountered in the work.

The Foundation Company, Limited, who have the work of construction in hand, have handled a considerable amount of under water work and their experience was put to the test in meeting and overcoming the problems that have arisen in the prosecution of this work.

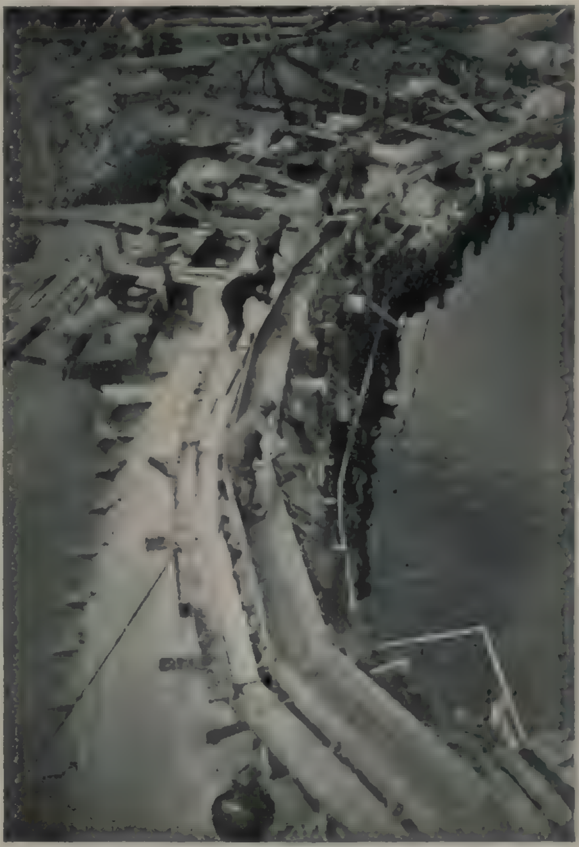
T. Pringle & Son, Limited, the engineers responsible for the design and supervision of the work, insisted on the rock bottom being exposed and thoroughtly cleared of loose rock or anything that might tend to adversely affect the foundation of the dam. The excavation was made by means of a clam shell bucket and the excavated material consisted of broken or powdered rock and shale. In many places it was necessary to excavate to a depth of 18 ft. before striking solid rock.

The forms for the coffer dams were built in panels and were cut to fit the rock bottom. The bottom was cleared by a diver who also fitted and tightened the forms for the coffer dams. Compressed air was used by the diver to clean the loose material off the rock bottom under water, and this means proved very successful. Brackets were constructed on the sides of the form panels and when these forms were fitted in place they were weighted with heavy boulders placed on top and on the brackets along the sides of the form panels.

The dam is being built in sections with expansion joints. In the first sections difficulty was experienced with water pouring through crevices in the rock bottom. The space between the coffer dams was pumped out, the rock bottom cleaned and the water allowed to find its level. A few feet of concrete was then placed under water to seal the bottom; 1½-inch pipes, placed about eight feet apart, were built in the concrete and after the concrete had set, cement grout was forced in under a pressure of 90 lbs. per square inch, to fill up the crevices and thoroughly cement the bottom.

Completed Section at East End

The gravel used in the aggregate was hauled from the pit, a distance of about one mile. The Brantford Municipal Railway was found to be situated in a direct line between the gravel pit and the new dam. The contractors purchased a trolley car and several 6-yard dump cars and hauled the gravel by this means over the railway line. A trestle was built out on the east bank of the river and the gravel was lifted by derrick from the cars or gravel dumps to the hopper of the mixing plant. The concrete mixer was located at the east abutment and the concrete was carried from there to the forms by chute, where it was placed by deep sea buckets.



General view showing method of bracing formwork

The amount of excavation necessary is much greater than was at first anticipated, but as the diver extended his examination it became apparent that the rock forming the river bed at this point was badly cracked and, in some cases, shattered. Up to date about 700 cu. yds. have been excavated.

The contractors plant consists of seven hoisting engines, two 35 h.p. boilers, three stiff leg derricks, and one guy derrick, five pumps, 2 in., 3 in., 6 in., and 10 in., one trolley car and eight 6-yard dump cars, one Manon Whirley ¾-yard steam shovel, one air compressor and one ¾-yard steam power concrete mixer.

The cementation method of overcoming water, employed in this work, should be of considerable interest to engineers and contractors. In the October 30, 1918, issue of the "Contract Record" we published an article describing the cementation processes of Francois and Portier, which has been little used in Canada. The success of the cementation process in this work should go a long way to encourage its general use by Canadian construction men.

New Pumping Station for Three Rivers

THE city of Three Rivers, P.Q., by reason of new industries, is adding to its population at an appreciable rate. A considerable amount of construction work is being carried out, in the way of shipyards, additions to the pulp and paper industries, and industrial cottages. In order to take care of the needs of the larger population, the city decided to improve its waterworks, and instructed Messrs. R. S. and W. S. Lea, consulting engineers, Montreal, to draw plans for a new pumping station and storage reservoir. The work has been carried out by Messrs. Arsenault & Plamondon, Ltd., Montreal, under the superintendence of Mr. Z. Lambert, the city engineer.

For many years the city has been supplied from a system of wells driven along the river shore for a distance of about 800 ft. The installation consists of 136 2 in., 2½ in., and 3 in. wells, connected to a 14 in. suction pump, from which the pumps draw their supply.

Construction View of Storage Reservoir

The old pumping station has been replaced by a new structure, adjacent to the wells. The plans of the superstructure of the building were drawn by Messrs. Asselin and Denoncourt, architects, Three Rivers. The building is 1 storey, 78 ft. 6 in x 29 ft. 6 in. The foundations are of reinforced concrete, 10 ft. thick, waterproofed. The slab at the bottom is 20 in. thick, and the side walls are of the same thickness. The superstructure is of rustic brick. The roof of the building is formed of a sloping cinder concrete roof slab, carried on light steel trusses, 1½ in. board, and finished with asbestos shingles supplied by the H. W. Johns-Mansville Co. Ltd. There are five large and nine small windows, the sills and keys of which have stone trimmings. The windows are fitted with wood sash.

The reservoir, situated 160 feet from the pumping station, is constructed of reinforced concrete. It is 101 ft. 8 in x 51 ft., and 18 ft. deep, the inside measurement being 95 ft. The roof is of reinforced concrete, the slab 6 in. thick, and the beams 12 x 18 in. Over the concrete is a covering of 30 ins. of earth to protect the water from the frost, the roof being 3 ft. above the street level. The roof is supported by 21 concrete columns, 15 x 15 in., and spaced 12 ft. centre to centre. On the street side of the reservoir a retaining wall of reinforced concrete is built; this is seven feet in depth, four feet of which is above the ground. The steel reinforcing bars were supplied by the Trussed Concrete Steel Co. of Canada.

Three Rivers Pumping Station

For immediate use the water is pumped from the wells into the distribution system, and that required for storage purposes is pumped through 12 in. and 8 in. pipes to the reservoir. These pipes are also connected with the distributing system, and are utilized by means of a system of valves when it is necessary to draw upon the reservoir water.

The judges of the Supreme Court of Ontario have appointed David J. Davidge, secretary of the Toronto Builders' Exchange, as a commissioner for the taking of affidavits and declarations. This appointment will benefit the members of the Exchange in the making of affidavits in the future.

A report before the British Ministry of Reconstruction recommends that the State should provide the whole cost of the building and should own the houses for, say, five years, at the end of which price may be expected to have attained a normal level. At the end of the transitional period, ownership of the houses is to be transferred to local authorities at a figure to be arrived at by deducting from the original cost such a percentage as represents the fall in price of materials and labor, with a fair allowance for depreciation.

Association of Canadian Building and Construction Industries

Formed at Enthusiastic Convention Held in Ottawa Nov. 26, 27 and 28—Every Phase of the Industry from Coast to Coast Represented—Detailed Report of Conference

The conference of Canadian Building Industries opened at Ottawa on the morning of Tuesday, Nov. 26th, with some eighty-five delegates present. To expedite the business of the conference, a meeting of the temporary executive, which has been carrying out the preliminary organization work, was held on Monday, and temporary officers for the opening of the convention chosen, Mr. Anglin being chairman, Mr. D. K. Trotter, secretary, and treasurer, Mr. Geo. A. Crain. Nominations had also been made for the membership of the various committees, and these were submitted for the approval of the conference.

Mr. E. R. Dennis, of Dennis Wire and Iron Works, London, and Mr. Robt. F. Dykes, of T. A. Morrison & Co., Montreal, and Mr. Walter Davidson of Toronto, were appointed a committee on points of order.

A resolution was presented to the meeting that the conference be called the "Conference of Canadian Building Industries," and be divided into three sections—general contractors, sub or trade contractors, and builders' supply men. This resolution was carried, the following officers being elected: Chairman of conference, Mr. J. P. Anglin, Montreal; vice-chairman, Mr. F. Armstrong of Port Hope Sanitary & Mfg. Co., Toronto; hon. secretary, Mr. A. H. Dancy of H. N. Dancy & Son, Toronto; hon. treasurer, Mr. G. A. Grain, Ottawa—these officers composing the conference executive, together with the chairman of each section—general contractors, Mr. Norman McLean, of Vancouver; sub-contractors, Mr. W. A. Mattice, of Dominion Bridge Co., Ottawa; supply—Mr. W. E. Ramsay, of Pedlar People, Ltd., Montreal.

Mr. G. A. Grain, of Ottawa, Mr. Alex. W. Bremner, of Montreal, Mr. W. A. Mattice, and Mr. Geo. E. Stocker, of Jas. A. Wickett, Ltd., Toronto, were elected as members of the finance committee, to present to the conference a statement of the conference liabilities and expenses to date, and further possible requirements, etc.

A publicity committee was appointed to confer with representatives of the press, to announce action of sectional meetings, to prepare and make public at the meetings all notice in connection with the conference, the members being Mr. G. B. Green, of Ottawa, Mr. J. S. Hooper, of Winnipeg, and Mr. E. A. Saunders, of Halifax; with one representative from each trade journal, and also one representative from each section, afterwards elected as follows: General contractors, Mr. Norman McLean, Vancouver; sub-contractors, Mr. E. R. Dennis, of Dennis Wire & Iron Works Co., London; supply, Mr. H. P. MacMahon, of St. Thomas.

Permanent Organization Committee

The members appointed to the committee on permanent organization were: Mr. George Oakley, Jr., of Toronto, chairman; Mr. W. E. Ramsay, of the Pedlar People, Ltd., Montreal; Mr. C. F. Smallpiece, of Taylor-Forbes Co., Ltd., Montreal; Mr. Fraser, of Fraser-Brace, Ltd., Montreal; Mr. E. R. Reid, of Engineers & Contractors, Ltd., St. John; Mr. E. A. Saunders, of Halifax; Mr. W. A. Wilson, of Wilson & Wilson, Ltd., Regina; Mr. Geo. Hayman, of London; Mr. Thos. Chick, of the Chick Contracting Co., Windsor; Mr. Tolime, of Victoria; Mr. J. Eadie, of Dingwall, Cotts & Co., Vancouver; Mr. Maxwell, of Toronto, Mr. Geo. H. Whitlock, of Whitlock-Marlett, Ltd., Moose Jaw, Sask.

The duties of this committee were outlined as follows: To consider the best basis on which the permanent organization of the Association of Canadian Building Industries may be formed, and to prepare and submit draft of by-laws and constitution, making a preliminary report; also consider such questions as future builders' exchanges; relations to board of trade and manufacturers' associations, etc.

Other committees were then appointed as follows:

Conference Arrangements Committee — Messrs. Mattice, Douglas, Crain, Peel, Watkinson. Moved by Mr. W. B. Champ, of Hamilton, seconded by Mr. Rowe, of Toronto.

Building Situation Committee

Building situation committee: Mr. M. P. Davis, of Ottawa; Mr. W. A. Mattice, of the Dominion Bridge Co., Ottawa; Mr. Jas. G. Shearer, of Montreal; Mr. F. A. Gillis, Halifax; Mr. Vaughan, of Montreal; Mr. Harry Hayman, of London; Mr. Lacey; Mr. E. Cass, of J. G. McDiarmid Co., Winnipeg; Mr. J. D. Johnston, of Toronto; Mr. Norman McLean, representing Contractors & Master Builders' Association, Vancouver; Mr. John Foley, of the Ottawa Construction Co.; a representative of the Rhodes Curry Co. Members representative of the three sections were afterwards added as follow General contractors—Mr. W. A. Wilson, of Wilson & Wilson, Ltd., Regina; Col. J. A. Little, of the Thunder Bay Harbor Improvement Co., Port Arthur; Mr. A. Dinnis, of Richard Dinnis & Son, Ltd., Toronto; Mr. Claude F. Secord, of P. H. Secord & Sons, Brantford; Mr. F. N. Paulin, of the Canadian Engineering & Contracting Co., Hamilton; sub-contractors—Mr. J. Mantle, of the Hamilton Bridge Works, Ltd., Hamitlon; Mr. F. McCausland, of Jos. McCausland & Son, Toronto; Mr. N. F. Gibson of the National Fireproofing Co., Toronto; Mr. W. H. Palmer, of Chatham; Mr. J. Douglas, of McFarlane-Douglas, Ltd., Ottawa; Supply—Mr. F. Armstrong, of the Port Hope Sanitary & Mfg. Co., Toronto; Mr. F. B. McFarren, of Inter-provincial Brick Co., Ltd., Toronto; Mr. Pierce, of Hamilton;; Mr. W. F. Evans, of Baines & Peckover, Ltd., Toronto; Mr. R. F. Dykes of T. A. Morrison & Co., Montreal.

Business Relations Committee

Business Relations Committee: Mr. Edwards; Mr. E. E. Poole, of Poole Construction Co., Regina; Mr. J. Gosselin, of Jos. Goselin, Ltd., Levis; Mr. John

W. Litton, Kingston; Mr. Herbert Elgie, Toronto; Mr. W. A. Chestnut, of Dickie Construction Co., Toronto; Mr. W. E. Dillon, Toronto; Mr. W. E. Gregory, of Murray & Gregory, St. John; Mr. Mitchell; Mr. Stewart N. Hughes, of Hughes & Co., Toronto; Mr. Geo. A. Perrier, Halifax; Mr. A. H. Dancy, of H. N. Dancy & Sons, Ltd., Toronto. Members elected sections: General contractors, Mr. Grant, of Grant & Horne, St. John; Mr. W. M. Irving, Montreal; Mr. Hugh Doran, of Doran & Devlin, Ottawa; Mr. Cass, of Winnipeg; Mr. W. S. Bellows, of Fegles-Bellows Construction Co., Fort William; Sub-contractors—Mr. A. Matthews, of A. Matthews, Ltd., Toronto; Mr. Jas. Ritchie, Ottawa; Mr. W. A. Mattice, Ottawa; Mr. Geo. Oakley, Jr., of Toronto; Mr. A. Nobbs, of A. & E. Nobbs, London; Supply—Mr. C. Pierce, of Hamilton; Capt. F. Moseley, of Canadian Fairbanks-Morse Co., Montreal; Mr. A. K. Cameron, of Metal Shingle & Siding Co., Montreal; Mr. M. Gibson, Toronto; Mr. E. F. McGovern, Northern Electric Co., Ottawa.

The meeting then adjourned till 3 o'clock.

A feature of the proceedings of the day was the luncheon, at which Hon. A. K. McLean, chairman of the Reconstruction Committee of the Privy Council, and Mayor Fisher were guests and speakers. Mr. Anglin introduced the speakers, pointing out that Mr. J. Pearson, architect, of Toronto, and Mr. Richard Wright, Chief Architect, of the Dept. of Public Works, were also present as guests. Mayor Fisher, in a brief speech, expressed great pleasure, as Mayor of the city, in welcoming to Ottawa all those who had assembled from outside points. He said that for many reasons they were always pleased to see people from any part of Canada in Ottawa. One was that it was the capital of Canada and it belongs to all. He pointed out that they were very much interested in building in Ottawa. A good deal had been done in the last few years both by the government and individuals, for, he jocularly remarked, one of the principal industries was putting up buildings to rent to the government. Some hoped the time was not far distant when the government would not be willing to occupy rented buildings, but that they would not only reconstruct what was destroyed, but that in Ottawa there would be erected departmental and governmental buildings such as were to be expected at the capital.

One of the questions in which those present were interested was housing, and the Mayor pointed out that was indeed a difficult problem at the present time. In Ottawa one of the things learned from the recent epidemic of influenza was the undesirable conditions under which many of the people lived. These epidemics revealed conditions as nothing else did. The difficulty was a great one. A building could not be put up to-day and rented at enough to pay three per cent. on investment. Prices might fall within a year, but who was going to put up buildings, facing a depreciation within the next few years? It seemed that the government would have to do something on the question.

Mayor Fisher, in closing, repeated his hearty welcome, assuring the delegates that it was a great pleasure indeed to him to have them assembled in Ottawa.

In introducing Hon. M. Maclean, Mr. Anglin said he thought he might safely assure him that when they got through with the work of the conference they would be in a position to co-operate with him or any other departments of the government in considering the questions that are common to the building industries. They would be willing to help in any policy the government might initiate, whether it was on the housing question or on a survey of the whole building situation in Canada, or whether it might be a project for the supply of building materials for devastated France and Belgium.

Hon. A. K. Maclean's Address

Hon. Mr. Maclean said that it was very desirable that men representative of any industry should meet occasionally to exchange thought in regard to their interests and to discuss one another's problems, and he was sure this meeting would be of benefit to those there assembled and he hoped it would also be of benefit to the country. They represented one of the greatest activities of Canada. With the exception of agriculture, the building industry employed more men than any other. They were gathered under exceptional circumstances. "The sun of peace has broken through the clouds. To-day our armies are marching on German soil, with their banners flying to the breeze. The German Emperor is without a country and German kings and princes are fleeing for refuge wherever they may find it. The Canadian army has distinguished itself and we have great right to be proud that they fought in what they believed to be a righteous cause."

The minister pointed out that the transition from work to war had been difficult, but a great deal had been accomplished. A splendid fighting force has been raised, while trade activities had been continued, and both war and trade financed, participating in a very substantial degree in the triumph of the allied armies. Surely, therefore, in the transition from war to work we should be able to face any difficulties. The transition from war to work was not as great as had been the transition from work to war, and Canadians might well face the future with courage.

One thing not to be forgotten was our capacity for development. Undoubtedly immigration will flow in shortly in vast numbers. The debt of Canada is exceedingly large for so small a country, but if we were favored with immigration that would become more proportionate as the population increased and when we came to have twelve millions of a population, the debt would be cut in half.

The reconstruction problems of Canada were quite different from those of some other countries. As to France and Belgium, there must be a material restoration of materials destroyed. It would take ten billion dollars to restore France. In business resulting from these great expenditures, we, as a belligerent, had a right to participate. France and Belgium could not be expected to finance the cost and that problem must become international. It was only natural that they should look to their allies, and the government had taken steps to point out to the powers that will assist these countries in their restoration programme, our ability and capacity to supply some of the materials that will be necessary, and also to assure the government of the ability of this country to finance these people, at least to the extent of what we will contribute in materials to the restoration of these countries. Already we had assurance of very large purchases of lumber for building purposes. Arrangements had not been fully completed, but it seemed that in so far as those interested in that class of business were concerned, they might be certain they would participate very largely.

In England they were proposing to erect between 300,000 and 400,000 buildings for housing—not all within a year or two, perhaps, but that was the programme laid out. In this project, as producers of certain forms of building materials, we must participate. So far as restoration work was concerned outside of Canada, we could count on a very large share of business, which would contribute to our prosperity in Canada, and help to solve one of the problems which confront us in the demobilization of our army and war workers. There were 200,000 engaged in munition work prior to the signing of the armistice, and there were probably 400,000 men overseas and in uniform, whose demobilization presented a possible problem. Personally, the Minister did not think it as great as some supposed.

His hearers were interested in certain problems connected with the building industry. Probably they had difficulty during the last three years. Most of them would never be charged with being war profiteers, but he imagined they were looking forward to the day when they could pay a good-sized business profits tax and income tax.

However, the war had presented problems which were particularly applicable to industries represented there. In the first place, it had resulted in an increased demand for housing. Secondly, there had been a cessation in repair of buildings. Thirdly, it had increased the cost of building and rates of interest, and fourthly, it had lessened the supply of building materials and, of course, costs had increased. These four matters were only some of the effects of the war on the industry. Mr. Anglin had given him figures in connection with building activities previous to the war. In the year 1912 in 35 of the leading cities of Canada, exclusive of railway work, dock work, etc., building construction amounted to $185,000,000 in 1913, the same cities had a total of $165,000,000. During the last three or four years there had only been $40,000,000 worth of building. Evidently therefore, there had been building deferred during the last three or four years at least to the extent of $100,000,000 per year, and he thought that taking Canada generally, deferred construction might be fairly estimated at at least $500,000,000, and one might safely say one billion dollars. If that was the demand, it presumed more activity and it meant prosperous times for Canada. What are the difficulties in carrying it out. The Mayor had suggested as a remedy that the government go on building and lend money to others. That was a very easy way, if it was practicable. He did not think it should be discarded entirely, and should be regarded with some favor within certain restrictions. Certainly there was the demand for construction, and all the building materials and all the labor necessary was available, and the Victory Loan showed that there was capital in this country and it should be available for safe and proper use. Unfortunately, however, in connection with building there is this problem. There is a probable loss for three to five or seven years equal to the depreciation of the value covering that period by reason of the abnormal building costs of to-day. It did not seem that building construction should cease on this account. There cannot be any rapid decline in prices in this country or in the world. Food prices must stand due to a greater demand. There was never such a shortage as now and that must play an important part in regard to the prices of building materials.

Mr. McLean said he would not endeavor to present a solution of this problem of high prices. He understood they were going to organize some committee and he hoped that before they left members of the Government might have an opportunity of meeting the committee so that they might discuss the problem and have their viewpoint as to how the Government should assist. It was a movement in which everyone should assist. In the building programme, governments, provincial and local, which have deferred construction programmes, should resume them at once. There are no restrictions to-day as to the issue of securities, so that these bodies are at liberty to procure money for construction projects. It appeared to be the duty of all representative bodies to give a lead to the people of Canada.

A great deal had been learned during the war—the value of standardization and economy, of up-to-date machinery, of co-operation, of organization. He did not say our industrial forces were subect to criticism for lack of these qualities, because in this country we could not look for these factors to be very prominent on account of our being still young and crude. But if these factors, which contributed so much to success during the war, are applied to the building industry and trades, they could not but benefit, and in that manner possibly a great deal of the enhanced cost of to-day might be absorbed.

"We learned how to run the war while we were waging it, and we will learn how to meet and solve our problems as the days go by, particularly if we make up our minds we are going to meet them successfully, and therefore the prospect may be considered most hopeful and bright by everyone in this room."

Mr. Anglin expressed the thanks of the delegates to Hon. Mr. Maclean and pointed out that one of the mottoes for the future must be "The maximum production for every Canadian."

Tuesday's Afternoon Session

At the resumption of the conference at the afternoon session, Mr. Anglin read a number of communications. There was a telegram from Mr. D. A. Garber, president of the General Contractors Association of America, stating that this organization had just been formed in Chicago, on the 19th and 20th, and inviting the Canadian contractors to join with them. Another lengthy telegram was received, signed by the president of the Royal Architectural Institute of Canada, expressing the support of the Institute in regard to the protest which it was understood the building men gathered in Ottawa intended to make to the Government in regard to the letting of contracts to alien contractors. A letter was also read from the Minister of Labor, Senator Gideon Robertson, thanking the conference for the invitation to address them, and stating that he hoped to be in a position to give the organization some information that would be of assistance. Another letter was received from Mr. Thomas Adams, who had been invited to address the conference, but who was unable to do so owing to business engagements taking him out of Ottawa. Other communications, all in the same hearty tone of endorsation, had been received, Mr. Anglin said, but time did not permit of their being read.

Mr. F. Armstrong, vice-chairman of the conference, was then requested to preside and routine business was proceeded with.

Committee on Labor Conditions

A committee on labor conditions was appointed, consisting of the following: Mr. Bonnell, Mr. G. A. Crain, of Ottawa; Mr. D. K. Trotter, of Montreal; Mr. W. A. Quinlan, of Quinlan & Robertson, Montreal; Mr. J. R. Douglas, Ottawa. Further committeemen elected by sections: General—Mr. J. F. Schultz, of Brantford; Mr. W. J. Green, of A. E. Ponsford, Ltd., St. Thomas; Mr. A. I. Garvock, Ottawa; Mr. Wm. Weller, of A. Weller & Co., Ltd., Toronto; Mr. J. W. Litton, Kingston; Mr. F. C. Woodroffe, of Henry Morgan & Co., Ltd., Montreal; Mr. Thos. Painter, of Thos. Painter & Sons, Toronto; Mr. Bellows, Fort William; Mr. Jos. Gosselin, Jr., Lévis; Mr. W. A. Wilson, Regina. Trade—Mr. Jas. Phinnemore, Toronto; Mr. W. H. Palmer, Chatham; Mr. A. Tomlinson, Chatham; Mr. N. T. Reid, of Reid & Brown, Toronto; Mr. J. T. Blyth, Ottawa; Mr. G. F. Frankland, Toronto, representing the Society of Domestic Sanitary & Heating Engineers; Mr. E. R. Dennis, of Dennis Wire & Iron Works Co., London; Mr. J. Mantle, Hamilton; Mr. G. Perrier, Halifax; Mr. A. Matthews, Toronto.

Legal Affairs Committee

Mr. Whitlock, of Moose Jaw, and Mr. Grieve, were appointed to a Committee on Legal Affairs, and at later meetings of the various sections, the following names were added: General Contractors—Mr. Cass, of Winnipeg; Mr. John V. Gray, of Toronto; Mr. E. E. Poole, of Regina. Trade—Mr. W. E. Dillon, Mr. Jas. Phinnemore, Toronto; and Mr. Geo. Oakley. Supply—Mr. D. P. Hatch, of the Barrett Co., Montreal; Mr. W. Baxter, of Jas. Robertson & Co., Ltd., Montreal; Mr. W. F. Evans, Toronto.

Code of Ethics Committee

Code of Ethics Committee: Mr. A. K. Cameron, Montreal: Mr. Gerald H. Watkinson, of Taylor-Forbes Co., Ltd., Guelph; Mr. J. H. Shaver, of C. A. Dunham Co., Ltd., Toronto. Members added by sections: Mr. H. Fussing, of Fussing & Jorgenson, Montreal; Mr. Geo. E. Stocker. of Jas. A. Wickett, Ltd., Toronto; Mr. C. A. Chilver, of Merlo, Merlo & Ray, Walkerville; Mr. Doran, Ottawa; Mr. John W. Seens, of Canadian Bridge Co., Ltd., Walkerville. Trade—Mr. E. Geery, London; Mr. Stewart N. Hughes, Toronto; Mr. N. T. Reid, Toronto; Mr. G. A. Gardner, of A. Gardner & Co., Toronto; Mr. Geo. A. Perrier, Halifax.

Boost, Build or Bust.

Mr. Ramsay, of Montreal, suggested that after hearing the very able address of Hon. A. K. MacLean, the conference should adopt as its slogan, "Boost, Build or Bust."

The meeting then adjourned so that the three sections—general contractors, sub-contractors and supply men—might meet and choose their representatives on certain of the committees which provided for such addition. The full list of the names of those elected to committees by these sections have been given above.

The officers of the various sections elected to act during the conference were as follows: General contractors—Mr. Norman McLean, of Vancouver; vice-chairman, Mr. W. S. Bellows, Fort William; secretary, Mr. E. R. Reid, St. John; Trade section—Chairman, Mr. W. A. Mattice, Ottawa; vice-chairman, Mr. W. E. Dillon, Toronto; secretary, Mr. E. R. Dennis, London; Supply section—Chairman, Mr. W. E. Ramsay, Montreal; vice-chairman, Mr. M. F. Gibson, Toronto; secretary, Mr. W. P. Evans, Toronto.

WEDNESDAY MORNING, NOV. 27

The deliberations of the conference as a whole were resumed on Wednesday morning, with Mr. Armstrong in the chair. Mr. Armstrong pointed out that the meeting was convened for the purpose of hearing the reports of the various sub-committees, and that it was of great importance to have the greatest possible number of representatives present. He hoped that those gathered would not allow small matters which affected them personally to interfere with the greatest good of the greatest number.

Mr. Grant, chairman of the Committee on Business Relations, presented a preliminary report. After a careful consideration of the cost plus form of contract it had decided to recommend that a suitable form of contract be prepared by a committee appointed by the conference in general session. This clause was adopted, and on motion of Mr. E. R. Reid, seconded by Mr. J. A. Little, this committee was composed of Mr. Grant, Mr. Elgie, Mr. McGovern and Mr. Poole. With regard to foreign competition, the Business Relations Committee made the recommendation that the conference as a whole consider the question, and also a memorial which had been prepared by the Ontario Builders' Supply Association.

Permanent Organization Comm. Report

The report of the committee on permanent organization, presented in the form of a number of resolutions, was as follows:

Resolution 1.

Whereas there is at the present time no central organization in Canada having the interests of the building and construction business under its hand and

Whereas we believe that for this reason no stable conditions exist in this business, such a situation resulting in the failure to build up a reliable and virile profession,

Then be it resolved that for the betterment of these industries such a national organization shall be formed, whose duty shall be to establish and promote a new standard in the various phases of construction enterprise and,

That it is desirable that the headquarters of the proposed organization shall be the city of Ottawa,

That the name of the proposed organization shall be the Association of Canadian Building Industries,

That all individuals, firms or corporations, engaged in any branch of building industry, having their permanent offices in the Dominion of Canada shall be eligible for membership,

That the compiling of the by-laws and constitution of the association be left in the hands of the National Board.

Resolution 2.

Whereas we assembled here for the purpose of forming a national organization of Canadian building industries, fully recognize the existence of many Builders Exchanges and kindred organizations throughout Canada, which are doing excellent work of local interest in the various cities and towns in which they are active, and;

Whereas the desire of this national organization is to assist and encourage their work for the betterment of interests involved;

Therefore be it resolved that all existing Builders' Exchanges, associations and bodies composed of similar interests, and in the absence of such, that the Board of Trade of any locality be invited to affiliate and cooperate with this national body;

That the assessment of annual feees relating to existing co-operative organizations, as well as individual firms and corporations be determined by the National Board.

Resolution 3.

That the executive of this National Association be composed of a minimum of twenty-five members, selected by geographical location and embracing every section of the Dominion, including in its body a president, first vice-president, second vice-president, honorary secretary, honorary treasurer; with power to add to its membership as necessity demands.

Resolution 4.

That the proposed by-laws provide that the office of president shall be filled by a general contractor, first vice-president, a sub or trade contractor, and second vice-president, a supply dealer or manufacturer.

The report of the Committee on Permanent Organization was received as above, following which it was taken up clause by clause. Mr. McLean, of Vancouver, suggested that a clause be added making the name cover the entire construction field more clearly, and on motion of Mr. Sparling, of Toronto, seconded by Mr. Painter, of Toronto, the words "and construction" were added.

Clause 2 of resolution 1 caused some discussion.

The first clause of resolution 2, regarding the cooperation of existing bodies, was amended on motion of Mr. Baxter, by the substitution of "the section of the Board of Trade relating to the building and construction industries," instead of "Board of Trade."

Mr. Dillon was strongly opposed to the clause providing that a general contractor shall be president of the association and on his motion an amendment was made that all members of the association be eligible for any office.

Clause 2 of resolution 1 was re-opened for discussion on motion of Mr. Painter, seconded by Mr. Phinnemore. Mr. Painter wanted to know just what was meant by the provision that all individual firms having their "permanent" offices in the Dominion be eligible for membership. Mr. Oakley, chairman of the committee, said that what had been in their minds was Canada for Canadians, but at the same time they did not want to build a wall around the country and prevent foreign contractors who would establish their headquarters in Canada from coming in.

Buildings Situation Comm. Report

Mr.. Arthur Dinnis, chairman of the Committee on the Building Situation, presented the following recommendations of that committee:

1. That a committee wait on the Minister of Public Works and advocate the use of Canadian materials in the erection of all public buildings
2. That the Department of Public Works be asked to commence operations on all delayed public works as soon as possible.
3. That the Government call for tenders in the usual way on stated plans and specifications for all works let under the Dry Dock Subsidy Act.
4. That the Government grant substantial federal aid for the purpose of constructing permanent national roads and that such work be let by tender.
5. That any work for the Federal or Provincial Governments, municipalities, railways, corporations, etc., be let and executed under statutory form of contract.
6. That where commissions are appointed to undertake housing operations the Association of Canadian Building and Construction Industries shall have representation on the commission.
7. That the sub-committee be instructed to discuss with the Minister of Public Works the advisability of proceeding at once with the housing propositions now before the Government, with a view of providing proper accommodation for industrial workers, and eliminating slum districts in large centers.
8. That the development of the natural resources of Canada be subsidized wherever necessary to compete with foreign materials.
9. That this conference pledge itself never again to use German or Austrian made goods.

The report was received and taken up clause by clause as in the case of the former.

Mr. Oakley asked whether in the clause recommending that a committee wait on the Minister of Public Works and advocate the use of Canadian materials in all public buildings, whether it was intended to cover merely raw material or the finished product. Mr. Dinnis replied that both were included, and he considered it necessary that this principle be adhered to in order to bring about the fullest development of the country. Mr. Oakley did not think this would be reasonable, instancing the case of steel, of which the larger sections were not rolled in the Dominion. In the cut stone business, too, in which he was engaged, he believed that ninety per cent. of the men would go out of business if tied down to Canadian stone. The main idea should be to give the work to the artisan, while using the most adaptable materials.

Mr. Rutherford, of Montreal, moved that the words "wherever possible" be inserted, and after considerable discussion on both sides of the question, this motion carried.

In regard to clause 3, referring to the calling of tenders for works let under the Dry Dock Subsidy Act. Mr. McLean, of Vancouver, explained that the Government had followed the practice of calling for plans and specifications along with tenders. This put the contractor to considerable expense and if he failed to get the work he was out considerable money. He thought the only fair thing was for the Government to have stated, settled plans and specifications and call tenders in the usual way.

With regard to clause 9, that the conference pledge itself against the use of Austrian and German goods, Mr. Somer, commissioner for New Brunswick, expressed the opinion that this matter should depend on whatever action was taken by the Mother Country. Messrs. Ramsay and McLean were of the same opinion. The ruling of the chair was that, as a political question, it was beyond the scope of the meeting.

The Minister of Public Works

Hon. Mr. F. B. Carvell, Minister of Public Works, was chief guest of honor and speaker at the luncheon on Wednesday. Hon. C. C. Ballantyne, Minister of Marine and Fisheries, was also to have been present and to have given an address, but Mr. Anglin had, regretfully, to advise the gathering that the Minister was unable to attend, owing to the sudden illness of a friend of his, and a brother sub-contractor, Mr. Ballantyne, of Montreal. Another guest at the luncheon was Mr. David Ewart, veteran former chief architect of the Department of Public Works.

Hon. Mr. Carvell, in opening, said that perhaps he occupied an illogical position, as he was by profession a lawyer, but in the whirligig of affairs a year ago he had been appointed to his present office. He thought it appropriate that they congratulate each other on the victory which had been won on the battlefields of Europe. They were coming now, however, to the reconstruction period, and this gathering was one of the best evidences of the interest taken in this problem. There was never a time when as great problems faced the country; unusual measures had to be taken, and revenue raised by unprecedented methods. But considering the greatness of our natural resources, we had every reason to believe that we would pull through all right and that in a year or two, rapid development of the country would ensue.

The responsibility in this reconstruction period, he said, should be shared by the Government and the people. He had seen that the conference had been discussing the housing problem, but as that would be, in so far as the Government was concerned, a matter of policy, he could not make any very definite statements as to what measures would be taken by it.

One question which would naturally be asked was as to whether the Government proposed to tide the country over this critical period by providing as much employment as possible on public works. His department had been putting on the brakes as hard as possible during the past three or four years, but now he looked at the matter from a very different standpoint, and whatever money could be expended on necessary buildings, he thought the Government should go ahead, regardless of present high prices.

One problem which had been presented in every city was the staggering amount paid by the Government for rented buildings. They were paying in practically every case very much more than would be the rate of interest on buildings of their own. He had therefore been forced to the conclusion that even before the country got back to normal conditions, in all cities, it would be good business to house public servants in their own buildings. This would involve a large building programme, and it would be given very serious consideration, but as yet no definite statement of policy could be made public.

Referring to another important question, the Minister said that since he had been head of his department, there had been only two tenders which had not been let on the open tender basis. There was, however, a contention in some quarters that the work should be divided around and everybody given a share. His experience had been that when the Government gave out work at force account, the workmen got "that easy, government feeling," and he wished those present could give him a recipe for changing this into an active feeling. It was on this account that he had seen fit to adhere to the tender system of letting contracts.

He felt that, as a minister of the Government, he was not justified in discussing its policies any further, but thought it was the duty of the country to provide as much work as possible for labor. He also urged the duty of the individual in this matter. He thought that living costs might possibly go down by next spring, but in his opinion it would go down pretty slowly and labor costs would certainly go no faster. Therefore it was the duty of the employers to employ as many men as they could, at as good wages as they could, in order to tide the country over this period.

In conclusion Hon. Mr. Carvell expressed his great pleasure to be present and address the delegates assembled, and he extended to them an invitation to visit the new parliament buildings.

WEDNESDAY AFTERNOON SESSION

At the afternoon session on Wednesday, the conference was favored with a short address by Mr. Norman McLean, of Vancouver, as a representative of British Columbia. Mr. McLean complained in regard to the matters of tenders called by the Government, that sufficient time was not given the western men to submit their bids. He also urged that the federal authorities be asked to take action for the purpose of developing Canadian export trade, pointing how greatly this would benefit the British Columbia lumber business, for instance, by making it possible for the mills to keep running the year round.

Mr. Poole, of Regina, also spoke, as another western representative, endorsing Mr. McLean's remarks. He said that, in the Middle West, contractors generally had had a very hard time for two years following the outbreak of the war, due to the previous building boom, and during the past five years, conditions had been none too good. He suggested that not only should the conference take up the question of a standard form of contract, but also that of uniformity of Lien Laws and Workmen's Compensation Acts in the various provinces.

Mr. John Eadie, of Vancouver, said he was greatly impressed with the statement of the Minister of Public Works that much of the building to take place in the immediate future would have to be in the nature of public works. In regard to port development, he urged upon those present that this work was of national rather than of local importance, and asked their support in the efforts of Vancouver to have its harbor facilities extended.

The Finance Committee reported that the expense had run in the neighborhood of $500. A resolution was passed that any deficit be made up by voluntary contribution.

Afterwards the conference adjourned so that the three sections could meet separately to discuss the problems that affeected each in their own particular field.

In the general contractors' section, discussion centered around a memorial, which had been endorsed for presentation to the Government by the Ontario Builders' & Supply Association, and in the composition of which Mr. Herbert Elgie, of Toronto, had been chiefly instrumental. This was recommended by the general contractors' section for adoption as read, but at a later meeting of the general conference certain changes were made, after which it was presented to the Government. The memorial is reproduced later in this report.

Mr. Anglin emphasized the necessity for the permanency of the general contractors' section. It seemed to him the key-note of the success of the national organization that each section have its separate organization and have complete automony over matters affecting its own particular interest. He therefore urged the formation of the necessary machinery and suggested that another general contractors' conference be held next spring, calling together representatives of the different districts throughout Canada, with the object of perfecting the constitution.

On motion of Col. Litton, seconded by Mr. Dancy, it was resolved that the section be formed into a permanent organization.

It was decided that the officers should be chairman and secretary-treasurer and that both should be Ottawa men, so that they could keep in touch with the executive of the parent association, while the directors should be distributed over the country.

Officers of General Contractors' Section.

The election resulted as follows: A. I. Garvock, of Ottawa, chairman; G. A. Crain, of Ottawa, secretary-treasurer; Directors—J. P. Anglin, Montreal; J. Gosselin, Levis; E. Cass, of Winnipeg; H. Hayman, London; A. H. Dancy, Toronto. It was also resolved that the Builders' Exchanges be asked to appoint a general contractor as ex-officio member of this organization.

The officers elected by the other sections for the coming year were as follows:

Trade section—W. A. Mattice, of Ottawa, chairman; W. E. Dillon, of Toronto, vice-chairman; E. R. Dennis, of London, secretary.

Supply section—W. E. Ramsay, Montreal, chairman; J. M. Dupuis, Verdun, vice-chairman; W. F. Evans, Toronto, secretary.

General Conference

The meeting of the general conference was resumed at 8.30 p.m., when Mr. Francis Hankin, of Montreal, president of the Montreal Reconstruction Group, and Mr. J. R. Smith, of the fire prevention department of the Commission of Conservation, were invited to address the delegates.

Mr. Hankins' Address

Mr. Hankin took up the fundamental principles of reconstruction, emphasizing the necessity of a thorough co-operation of all concerned, and the consideration of industry as a unit rather than two antagonistic sections consisting of employers and employed. England, he said, had studied, during the war, the problems of reconstruction more than any other country. A ministry of reconstruction had been formed, a sub-committee of which had been appointed to consider the relations between employers and employed. This committee had recommended that the Government propose joint trade parliaments with equal representation. The object of such a measure was to create a corporate spirit in industry, and already the theory was working, industrial councils having been formed in twenty-six industries.

In regard to technical education, Mr. Hankin said that Great Britain had passed legislation which placed her in the forefront of the nations in that respect. This law made it compulsory that young people between sixteen and eighteen attend trade schools, during their working hours, the employers having to leave them free to do so.

Mr. Hankin pointed out that in this country National Reconstruction Groups were being formed throughout the Dominion. These groups were composed of ten to fifteen persons, including a representative of the returned soldiers and of labor. It was the aim to get both sides together and to overcome that antagonism which resulted when employer and employed only met as representatives of their separate organizations. In conclusion Mr. Hankin urged the support and help of those present.

Mr. Smith on Fire Waste

Mr. J. Grove Smith, of the Commission of Conservation, spoke on the very important subject of fire waste, and gave some startling figures on the loss attributable to this cause. In the last 50 years, property to the value of $450,000,000 had been destroyed, while the cost of insurance had been approximately $780,000,000. The waste was not decreasing, he pointed out. In 1914, the loss was $22,000,000; in 1915, $25,000,000; in 1916, $24,500,000, and for the first ten months of 1918, it was $28,750,000. An interesting point brought out was that 65 per cent. of the total fire waste in this country occurred in 5 per cent. of our fires.

Mr. Smith urged that the reason why fire prevention measures had not been more successful was on account of the shifting of responsibility between the Dominion, Provincial and Municipal governments. He pointed out that there was a fire prevention association, but the results were lacking because of the absence of co-ordination. There was no plan of attack and the education of the public did not go far enough. It was plain that the matter must be adjusted by law. In this connection, the speaker emphasized the necessity of town-planning and of the regulation of the development of our towns and cities with a view to the prevention of fire. He also urged that building codes should be standardized.

Mr. Thos. Adams, who had been invited to address the conference was unable to attend, but a letter received from him was read by Mr. F. Armstrong.

Letter from Town Planning Adviser

The letter expressed Mr. Adams' regret that he could not be present. He was glad, however, to note that they were discussing building by-laws and similar topics. "Without entering into the question of relative degree of responsibility that may attach to the federal or provincial governments," the communication proceeded, "I think I shall be echoing the unanimous view of those who have considered the housing problem in stating that some form of centralized machinery is needed to stimulate and direct building construction, particularly in connection with the building of small houses for working men. We need to have more research made into the numerous technical problems in connection with building, many of which have been the subject of little scientific study in the past, and we need also to so marshal and disseminate the knowledge accumulated that it will be accessible to all who can make practical use of it."

Mr. Adams expressed approval of the scheme to create a bureau to carry out this work. Such a bureau should also give expert advice on questions of planning the land, streets and houses, and of administration of public and private schemes. At a time when we were passing through a transition in our industrial life, such expert advice would be most valuable.

It also appeared likely that for a time at least, some form of public contribution would have to be made, either as grants or loans, to assist municipalities, and the different forms of private enterprise through the municipalities, to carry on building until capital becomes more plentiful and private investment in building becomes more secure.

The housing question was considered one of national importance in Great Britain and the United States, and its solution in this country seemed to necessitate action on the part of all three governments—

A partial group of delegates in attendance at the recent Conference of Building

federal, provincial and municipal—the action being primarily advisory on the part of the federal government and executive on the part of the municipalities.

It was pointed out also in Mr. Adams' letter how important it was that any organization which may set up to deal with the question of housing should also take into its purview the question of planning. If the best results were to be obtained from the efforts of the builders to get houses at an economical price, there must be more economical methods of planning.

After reading Mr. Adams' letter, Mr. Armstrong said he did not intend to discuss the housing question, but he took opportunity to express his admiration and appreciation of the work done by Mr. Anglin in organizing the conference. He had never been at a conference at which the work had beeen so well laid out and he pointed out that never before had the Ministers of the Government been so willing to meet representatives of the building industry.

Mr. Anglin, in reply, declared that the conference was sufficient recompense to him for any little work he had done, and said that it was not the result of the work of one man, for that men from Montreal, Toronto, London and Ottawa had been present at all the organization meetings.

Business Relations Comm. Report

The report of Committee on Business Relations was then presented by Mr. Grant, its chairman. This report comprised three resolutions, as follows:

Resolution No. 1

This committee, after carefully considering (a) Percentage, (b) Cost plus fixed sum, (c) Lump sum methods of payments, recommend that a standard form of contract be framed by a suitable committee appointed by the permanent executive. Moved by Mr. Elgie, Toronto; seconded by Mr. Chestnut, Toronto.

Resolution No. 2

Whereas it is vital to the interest of contractors that their business should be stablished, and whereas the competition of incompetents is not only disastrous to the legitimate contractor, but is also detrimental to the public interest;

And whereas the present system of awarding contracts does not encourage the best work;

Therefore Resolved that advertisements for tenders for public works should state the time and place for a public opening of said tenders and before any tender be accepted that qualifications of the tenderer from the standpoint of experience, ability and equipment, be ascertained, and that a copy of this resolution be forwarded to all Departments of Public Works, Federal and Provincial, and to leading Municipal and Industrial Corporations. Moved by E. R. Reid, St. John, N. B.; seconded by J. A. Little, Port Arthur, Ont.

Resolution No. 3

That the Conference be asked to consider the question of foreign competition, and also the Memorial prepared by the Provincial Association of Contractors of Ontario. Moved by Mr. Elgie, Toronto; seconded by Mr. Cass, Winnipeg.

The first two resolutions were carried unanimously, but the third, in regard to the consideration of foreign competition and of the memorial prepared by the provincial association of contractors of Ontario, aroused a very spirited discussion. This memorial, as originally presented, was as follows:

Memorial—to the Rt. Hon. Sir Robert L. Borden, P.C., G.C.M.G., K.C., LL.D. And to the Hon. the Members of the Government of the Dominion of Canada:

This Memorial Humbly Sheweth:

Upon behalf of the contractors of the Dominion of Canada, we, the undersigned, respectfully request no public works of any nature should be undertaken in the Dominion of Canada except by Canadian contractors, and, that this also apply to all concerns acting for the Government or operating under Dominion incorporation. In support of that request, we beg to set before you the following consideration:

(1) The Canadian contractors have demonstrated over and over again their ability to erect structures of any kind whatsoever required for the purpose of their own country.

(2) Canadian contractors are interested in the welfare of Canada, and contribute to its taxes and to its growth, whilst contractors of other countries merely make money in Canada for the purpose of spending it in the country to which they may happen to belong. They also have a tendency to recommend and use foreign materials which is an injury to Canadian industries.

(3) Canada has made such generous contributions towards the successful prosecution of the war that the Government of the country should see to it that every line of activity is safeguarded, because it is becoming more and more evident that one industry of our country cannot suffer without every other industry suffering with it.

(4) Patriotic contractors, as well as architects and engineers of military age have volunteered to fight at the front and for other duties in the war, and thereby have established a claim for consideration towards their fellow contractors.

(5) The business of contractors has been greatly interfered with by the patriotic necessities occasioned by the war, so that the work to be done, even if executed by Canadian contractors alone, is not more than sufficient for their needs.

Respectfully it is submitted that if due weight is given to the above considerations, one course only will commend itself to you and to other members of your Government, namely to take every pains to see that the construction of public

truction Interests held in the Chateau Laurier, Ottawa, November 26, 27 and 28.

works of any nature is entrusted to Canadian contractors and to them only.

Mr. J. Fraser Gregory, of Murray & Gregory, St. John, stated that the supply section had considered the memorial, and that, in view of the remarks of the Minister of Public Works at their luncheon and the thoroughly Canadian and patriotic attitude he had displayed, it was ill-timed, uncalled for, and beyond the scope and desires of the convention. He therefore moved a resolution to the effect that it be not considered by the conference.

The contentious portion of the memorial was clause 2, objection being taken to the words, "whilst contractors of other countries merely make money in Canada for the purpose of spending it in the country to which they happen to belong. They have also had a tendency to recommend and use foreign material which is an injury to Canadian industries."

Mr. Gregory's motion was lost, and the memorial was taken up clause by clause, each being carried, with the exception of No. 2, which, on motion of Mr. E. R. Reid, seconded by Mr. Little, was cut out. It was then resolved that the memorial, as amended, be adopted and presented to the Premier.

At the resumption of the conference on Thursday morning, it was announced that the total register to date was: Supply men, 92; general contractors, 65; sub-contractors, 34; making a total of 191.

The report of the Committee on Labor Conditions was then presented. This committee considered that rates of wages was outside their province and had confined themselves to a discussion of how the quality of labor might be improved.

"The avenues which present themselves to us, as building industries are three," stated this report.

First. By an active interest in all that pertains to the physical well being of the worker, particularly in the matter of housing.

Second. By a proper system of apprenticeship in all trades, through systematic training, through a personal outlay by every member of this association in the training of apprentices, both of time and money, through a broader appreciation of the fact that it is the duty of each and every member to take this matter upon his own shoulders.

Third. Through the promotion of technical training, which can be done by each individual contractor, interesting himself in this matter in his own district and bringing pressure to bear on municipal, provincial and federal governments, to establish this method of education and enlarge the scope of it throughout Canada.

This committee is further of opinion that a memorial should be prepared by this permanent committee for presentation to the Dominion Government, urging the vital necessity of an immediate large financial grant at the next Session of Parliament, for the furtherance of Technical Education, and with this in view, has appointed a sub-committee to ascertain the present position of the Dominion Government towards technical education, and to collate such data as would form the basis of a memorial. This sub-committee's report is appended hereto.

Report of Sub-Committee

To the Chairman, Committee No. 14:

We beg to submit the following memorandum re position of Dominion Government towards technical education, as containing data for the preparation of a memorial by Committee of the, Association of Canadian Building and Construction Industries to be presented to the Dominion Government:

(a) Up to the present time the Dominion Government has not given any financial assistance to the promotion of technical education.

(b) The activities of the Dominion Government in this matter have consisted in the appointing of a Commission, under Dr. J. W. Robertson to make a thorough investigation of technical education. In 1913 this Commission submitted a report. This report was published and has had wide distribution.

(c) Financial aid or assistance has been granted by the Dominion Government, firstly, one million dollars ($1,000,000.00) per annum, for the furtherance of agricultural education; secondly, a substantial amount yearly for the furtherance of education in the Fisheries Branch; and, thirdly, the sum of ninety thousand dollars ($90,000.00) annually for the promotion of industrial research.

(d) The recommendation for financial assistance by the Dominion Government for technical education made in Dr. Robertson's report, consisted of the following, the sum of three million dollars per annum for a period of ten years, and the sum of three hundred and fifty thousand dollars per annum for pre-vocational work in the schools.

(e) It is to be noted that this recommendation was made prior to the war, and it is the opinion of this committee that, provided the amounts asked for in Dr. Robertson's report will take care of the requirements of Canada in technical education in co-operation with the provincial and municipal governments, conditions in Canada to-day warrant and imperatively called for the making available immediately of a vastly greater initial sum of money so that an immediate stimulus may be given to this vital matter and the young soldiers returning to civil life, can be benefitted thereby.

(f) It is a matter for the expression of great pleasure that in the late conference between the Dominion Cabinet and the premiers of the various provinces this question of technical education was fully discussed and that warm interest was shown by the members of the Dominion Cabinet.

(g) It should be emphasized in this memorial that for the upbuilding of Canada, it is just as vitally necessary that the Dominion Government provide money for technical education of the workers of Canada as they should provide for the upbuilding of the ship-building industry or provide credits for the sale and export of agricultural or live stock products.

(Signed) J. T. Blyth
G. F. Strickland
Sub-Committee.

The following is the text of resolution which your committee has to submit for the consideration of the conference.

Be it resolved that the executive of this association do appoint a permanent committee to be called a committee on labor, which shall have the following duties assigned to it.

(1) To consider all legislative matters in the Dominion Parliament and the Provincial Legislatures affecting labor in the building and construction industries.

(2) To foster and aid all the movements and activities which will directly or indirectly increase the efficiency of labor, physically and mentally, and improve its quality, particular attention being given to the following:

(a) The housing of the worker.

(b) The development of the apprenticeship system.

(c) The immediate establishment and furtherance of technical education throughout Canada.

The Committee on Legal Affairs, Chairman, Mr. Poole, of Regina, recommended:

(1) That the executive appoint a standing committee to investigate the feasibility of standard building by-laws throughout Canada and to consider ways and means to carry same into effect.

(2) In view of the difficulty in connection with the variation of the lien laws to the different provinces at the present time and the serious difficulty caused by unfamiliarity with existing laws, that the executive have a pamphlet prepared for distribution to members of this association describing the various lien laws in the different provinces.

The following recommendations were submitted in the report of the Committee on Code of Ethics, of which Mr. Stocker was chairman:

1. When general contractors submit their tenders to the architect or owner, the general contractor should list the names of the sub-contractors whose tenders he used and advise the sub-contractor. In the event of his tender being accepted, the general contractor should notify his sub-contractor immediately. The same conditions should obtain with respect to sub-contractors and their respective supply men.

2. It is recommended that the sub-contractors shall receive payment in the same proportion and substantially at the same time as payments are received by the general contractor.

3. That the matter of bonds, bonus and penalties, as between general and sub-contractors be left to their own individual arrangements to suit specific conditions, but when requested, shall be on a proportionate basis.

4. Zones of operation.—In view of the fact that in several districts of the Dominion there are at present no branches of this association or duly representative bodies, we recommend that the appointment and location of zones of operation be deferred until representative sections have decided to co-operate.

The report of the Nominating Committee was next presented, and after some discussion the following list of officers and directors were chosen to compose the executive:

Executive Officers

President—J. P. Anglin, Montreal.
Vice-Presidents—
  Nova Scotia, J. C. Harvey, Halifax.
  Prince Edward Isl'd. (to be elected).
  New Brunswick, J. A. Grant, St. John.
  Quebec, P. A. Galarneau, Quebec.
  Ontario, Fred Armstrong, Toronto.
  Manitoba, E. Cass, Winnipeg.
  Sask., W. A. Wilson, Regina.
  Alberta, J. E. McKenzie, Calgary.
  B. C., N. McLean, Vancouver.
Hon. Treasurer—G. A. Crain, Ottawa.
Hon. Secretary—A. H. Dancy, Toronto.

Committee—A. D. Smith, Amherst, N.S.; E. R. Reid, St. John, N.B.; J. F. Tilton, St. John, N.B.; Jos. Gosselin, Levis, P.Q.; W. H. Ford, Montreal, P.Q.; Wm. Irving, Montreal, P.Q.; James Ballantyne, Montreal, P.Q.; Wm. Rutherford, Montreal, P.Q.; W. E. Dillon, Toronto, Ont.; Walter Davidson, Toronto, Ont.; James Phinnemore, Toronto, Ont.; Geo. Oakley, Jr., Toronto, Ont.; J. F. Schultz, Brantford, Ont.; A. T. Enlow, Hamilton, Ont.; H. Hayman, London, Ont.; W. R. Geikie, Oshawa, Ont.; A. C. Nobbs, London, Ont.; Thos. Chick, Windsor, Ont.; Col. J. A. Little, Port Arthur, Ont.; H. T. Hazelton, Winnipeg, Man.; T. R. Deacon, Winnipeg, Man.; W. P. Alsip, Winnipeg, Man.; One to be appointed by the Builders' Exchange, Winnipeg, Man.; Duncan Smith, Saskatoon, Sask.; E. E. Poole, Regina, Sask.; W. R. MacKenzie, Regina, Sask.; G. H. Whitlock, Moose Jaw, Sask.; Chas. Forbes, Moose Jaw, Sask.; four to be nominated later for Alberta; four names from British Columbia to be furnished by Mr. McLean; G. A. Perrier, Halifax; Stewart Hughes, Toronto.

Ex-officio Members—W. E. Ramsay, Montreal, Chairman Supply Committee; A. I. Garvock, Ottawa, Chairman General Committee; W. A. Mattice, Ottawa, Chairman Subcontractors' Committee.

Mr. Anglin's election as president was unanimous and enthusiastic. In thanking the conference for their choice, he said the task was a heavy one, but he was very grateful for the honor. He also pointed out that a meeting of the representatives from Quebec Province had been held with the object of forming a provincial section.

To avoid difficulty due to the multiplicity of vice-presidents it was decided to appoint Mr. Fred Armstrong as vice-chairman of the Association.

The Thursday morning session ended the business of the conference.

Delegation Interviews Government

At noon the delegates assembled in the Railway Commission's offices to present the resolutions which had resulted from their deliberations to the members of the Dominion Cabinet. Sir Thomas White, acting Premier, Hon. F. B. Carvell, Minister of Public Works, and Hon. Mr. Reid, Minister of Railways, received them.

Mr. Armstrong presented the resolutions which comprised the first eight included in the report of the Committee on the Building Situation (See page 961) as approved and amended by the conference.

Each resolution was briefly explained by Mr. Armstrong. Sir Thos. White, in reply, pointed out the difficulties which faced the country, and said that for a period there might be considerable unemployment. He thought one of the best ways to assist in maintaining our prosperity was to obtain a large block of

Registration at Ottawa Conference of Canadian Building Industries

GENERAL CONTRACTORS

J. S. Adamson (W. G. Adamson), Ottawa.
J. P. Anglin (Anglin's Limited), Montreal.
James Bogue (General Contractor), Peterboro.
G. A. Crain (G. A. Crain), Ottawa.
W. S. Bellows (Fegles Bellows Engineering Co.), Fort William.
Cadwell, C. W. ((Cadwell Sand & Gravel Co.), Windsor.
E. Cass (The McDiarmid Co.), Winnipeg.
Chestnut, W. A. (Dickie Construction Co., Ltd.), Toronto.
Thos. Chick (Chick Contracting Co.), Windsor.
Senator Curry (Rhodes Curry Co., Ltd.), Amherst, N.S.
A. H. Dancy (H. N. Dancy & Son, Ltd.), Toronto.
Walter Davidson (Walter Davidson & Co.), Toronto.
Hugh Doran (Doran & Devlin), Ottawa.
W. Doran (Doran & Devlin), Ottawa.
Arthur Dinnis (Richard Dinnis & Son, Ltd.), Toronto.
H. Elgie (H. Elgie), Toronto.
John Foley (Ottawa Construction Co.), Ottawa.
E. R. French (E. R. French), Toronto.
H. Fussing (Fussing & Jorgenson), Montreal.
A. I. Garvock (A. I. Garvock), Ottawa.
Geo. W. Garnett (Thos. Garnett & Sons), Port Hope.
Jos. Gosselin, Jr. (Jos. Gosselin), Levis, Que.
Col. F. Gourdeau (Concrete Construction, Ltd.), Ottawa.
W. J. Green (A. E. Ponsford, Ltd.), St. Thomas.
Jno. V. Gray (John V. Gray Construction Co., Ltd.), Toronto.
J. A. Ewart (Grant & Horne), St. John, N.B.
H. Hayman (H. Hayman), London.
C. Hilbert (C. Hilbert), Toronto.
John C. Holtby (Holtby Bros), Toronto.
A. R. Holmes (Archibald & Holmes), Toronto.
W. H. Hutchinson (Baldry, Yerburgh & Hutchinson, Ltd.), St. Catharines.
James A. Hughes (James A. Hughes), Welland.
W. M. Irving (W. M. Irving), Montreal.
J. A. Little (Thunder Bay Harbour Improvement Co.), Port Arthur.
Arthur J. Jarvis (Atlas Construction Co.), Montreal.
Chas. Holbrook (Chas. Holbrook & Son), Ottawa.
Jno. W. Litton (John W. Litton), Kingston.
R. N. Jones (R. N. Jones), Ottawa.
Col. Robert S. Low, (Bate, McMahon & Co.), Ottawa.
J. Arthur Marier (Marier & Tremblay, Ltd.), Quebec.
Walter Page (Page & Co.), Toronto.
Thos. Painter (Thos. Painter & Sons), Toronto.
F. N. Paulin, Canadian Engineering & Contracting Co., Hamilton
G. M. Pitts (Pitts Construction Co.), Ottawa.
E. E. Poole (Poole Construction Co. Ltd.), Regina.
A. A. Proulx (A. A. Proulx), Ottawa.
W. A. Quinlan (Quinlan & Robertson, Ltd.), Montreal.
E. R. Reid (Engineers & Contractors, Ltd.), St. John, N.B.
E. A. Saunders (E. A. Saunders), Halifax, N.S.
J. F. Schultz (Schultz Bros. Co.), Brantford.
Claude F. Secord, P. H. Secord & Sons, Ltd.), Brantford.
John W. Seens (Canadian Bridge Co. Ltd.), Walkerville.
James G. Shearer (James Shearer Co. Ltd.), Montreal.
Wm. F. Sparling (Wm. F. Sparling Co. Ltd.), Toronto.
Alex. Stuart (Stuart Bros.), Hamilton
Geo. E. Stocker (Jas. A. Wickett, Ltd.), Toronto.
D. K. Trotter (David K. Trotter), Montreal.
Wm. Weller (A. Weller & Co. Ltd.), Toronto.
J. L. Weller (J. L. Weller), St. Catharines.
W. A. Wilson (Wilson & Wilson Ltd.), Regina
F. C. Woodroffe (Henry Morgan & Co. Ltd.), Montreal.

SUB-CONTRACTORS

F. Armstrong (F. Armstrong Co.), Toronto.
J. T. Blyth (J. T. Blyth), Ottawa.
W. B. Champ (Hamilton Bridge Works Co), Hamilton.
E. R. Dennis (Dennis Wire & Iron Wks. Co.), London.
W. Dillon (W. Dillon Co. Limited), Toronto.
J. R. Douglas (McFarlane-Douglas Co. Ltd.), Ottawa.
J. B. Duford (Duford Limited), Ottawa.
Geo. H. Duncan (Duncan Bros.), Peterboro.
W. G. Edge (W. G. Edge Limited) Ottawa.
G. F. Frankland (Toronto Society of Domestic, Sanitary & Heating Engineers), Toronto.
G. A. Gardner (A. Gardner & Co.), Toronto.
N. F. Gibson (National Fire Proofing Co.), Toronto.
Wm. Hiller (Canadian Johns-Manville Ca. Ltd.), Toornto.
R. Hooper (Hooper Bros.), Ottawa.
Wm. J. Hynes (W. J. Hynes, Limited), Toronto.
Stewart N. Hughes (Hughes & Co.) Toronto.
P. H. Jamieson (Canadian Asbestos Co.), Montreal.
J. P. Mantle (Hamilton Bridge Works Co), Hamilton.
Fred B. Locker (G. R. Locker Co.), Montreal.
A. Matthews (A. Matthews Ltd.), Toronto.
W. A. Mattice (Dominion Bridge Co. Ltd.), Ottawa.
F. H. McCausland (Jos. McCausland & Sons Ltd.), Toronto.
John McKinley (McKinley & Northwood), Ottawa.
A. C. Nobbs (A. & E. Nobbs, London.
Geo. Oakley Jr. (Geo. Oakley & Son Ltd.), Toronto.
Chas. D. Oakley (Geo. Oakley & Son Ltd.), Toronto.
W. H. Palmer (W. H. Palmer), Chatham.
Geo. A. Perrier (Geo. A. Perrier), Halifax.
Chas. T. Pearce (Pease Foundry Co.), Toronto & Winnipeg
Jas. Phinnemore (Jas. Phinnemore), Toronto.
N. K. Reid (Reid & Brown), Toronto.
J. Ritchie (James Ritchie), Ottawa.
D. M. Rowe (D. M. Rowe & Co.), Toronto.
A. Tomlinson (Albert Tomlinson), Chatham.

SUPPLY DEALERS

A. Walter Allen (Dominion Radiator Co., Ltd.), Toronto.
Fred Armstrong (Port Hope Sanitary Mfg Co.), Port Hope.
S. R. Armstrong (Municipality of Peterboro), Peterboro.
R. A. Baines (Baines & Peckover), Toronto.
Geo. M. Bailey (W. J. Hynes Ltd.), Toronto.
W. P. Baxter (James Robertson & Co. Ltd.), Montreal.
F. E. Belfry (Asst. Architect, Military Hospitals), Ottawa.
W. D. Bliss (The Barrett Co. Ltd.), Montreal.
E. M. Barrett (Barrett Bros.), Ottawa.
Alex. W. Bremner (Alex. Bremner, Limited), Montreal.
A. J. J. Brennan (Municipality of Welland), Welland.
Chas. Bulley (Standard Brick Company), Toronto.
James A. Burnard (Seaman Kent Co), Meaford.
A. K. Cameron (Metal Shingle & Siding Co), Montreal..
Thos. M. Burkett (Hardware), Ottawa.
C. A. Chilver (Merlo, Merlo & Ray), Walkerville.
C. A. Chilver (C. A. Chilver & Co. Ltd.), Walkerville.
Arthur Cope (A. Cope & Son), Hamilton.
Chas. V. Clark (Darling Bros. Ltd.), Montreal.
David J. Davidge (Toronto Builders' Exchange), Toronto.
A. M. Davis (McAuliffe, Davis Lumber Co.), Ottawa.
J. P. Dupuis (J. P. Dupuis, Ltd.), Verdun.
Robt. F. Dykes (T. A. Morrison & Co.), Montreal.
John Eadie (Dingwall, Cotts & Co.), Vancouver.
E. R. Eaton (J. R. Eaton & Sons, Ltd.), Orillia.
Gordon C. Edwards (W. C. Edwards & Co.), Ottawa.
F. W. E. Smonder (Gurney, Massey & Co. Ltd.), Montreal.
W. F. Evans (Baines & Peckover), Toronto.
R. H. Falkiner (Allith Manufacturing Co. Ltd.), Ottawa.
O. Forest (The Ottawa Fireproof Supply Co.), Ottawa.
P. A. Galarneau (Citadel Brick Co. Ltd.), Quebec.
F. A. Gillis (F. A. Gillis Co. Ltd.), Halifax.
G. B. Greene (General Supply Co. of Canada), Ottawa.
J. Fraser Gregory (Murray & Gregory, Ltd.), St. John, N.B.
R. A. Hanraker (Canadian Johns-Manville Co. Ltd.), Montreal.
D. P. Hatch (The Barrett Co. Ltd.), Montreal.
Sackville Hill (Sackville Hill), Hamilton.
J. D. Johnson (Canada Cement Co.), Montreal.
Jno. S. Hooper (Winnipeg Builders' Exchange).
Mayor J. M. Hughes (Municipality of Kingston), Kingston, Ont.
Geo. C. Keithing (Industrial Board), St. Thomas.
T. Sidney Kirby Co. Ltd. (T. Sidney Kirby Co. Ltd.), Ottawa
John F. Lawson (Pedlar People, Ltd.), Oshawa.
Geo. J. Lippert (Municipality of Kitchener), Kitchener, Ont.
J. M. G. Lockerby (Alex. McArthur Co. Ltd), Montreal.
J. A. Lafres (Canada Cement Co.), Montreal.
Chas. Lowrey (Queenston Quarry Co.), St. Davids, Ont.
Thos. McCord (S. McCord), Toronto.
D. B. McCoy (Steel Co. of Canada, Ltd.), Hamilton.
F. B. McFarren (Interprovincial Brick Co. of Can.), Toronto.
E. F. McGovern (Northern Electric Co. Ltd.), Ottawa.
D. J. MacKenzie (D. J. MacKenzie & Co.), Ottawa.
D. J. MacKenzie (National Brick Co. of Laprairie), Montreal.
Norman McLean (Contractors Master Builders Ass.), Vancouver
H. P. McMahon (Municipality of St. Thomas), St. Thomas
J. Arthur Marier (Marier & Trembley Ltd.), Quebec.
Geo. M. Mason (Geo. M. Mason, Ltd.), Ottawa
W. G. Massiah (Sherwin-Williams Co.), Ottawa
Capt. F. G. Moseley (Canadian Fairbanks-Morse Co.), Montreal
W. H. Murphy (Pease Foundry Co. Ltd.), Ottawa.
John Newstead (Municipality of Guelph), Guelph
G. Barclay Nicol (General Supply Co. of Railway Contractors & Mill Supplies), Ottawa.
J. P. O'Shea (J. P. O'Shea & Co.), Montreal
O. N. Parent (Canadian Yale & Towne, Ltd.), St. Catharines
Hugh Peel (Pedlar People Ltd.), Ottawa
Chas. T. Penn (Indiana Quarries Co. Cleveland Stone Co.), Toronto
W. E. Ramsay (Pedlar People, Ltd.), Montreal.
E. Ramus (Builders' Sales Ltd.), Ottawa
I. C. Reynolds ("Contract Record"), Toronto
Wm. Rutherford (Wm. Rutherford & Sons Co.), Montreal
R. G. Saville (Port Hope Sanitary Mfg. Co.), Montreal
A. G. Rose (Jas. Davidson & Sons), Ottawa
J. H. Shaver (C. A. Dunham Co., Ltd.), Toronto
Jas. G. Shearer (The James Shearer Co. Ltd.), Toronto
C. F. Smallpiece (Taylor Forbes Co. Ltd.), Montreal
Sumner & Co., Moncton, N. B.
G. J. Steele (Standard Brick Co.), Toronto
I. F. Tilton (W. H. Thorne & Co. Ltd.), St. John, N.B.
T. F. Turner ("Contract Record"), Toronto
Gerald H. Watkinson (Taylor Forbes Co. Ltd.), Guelph
A. H. Webster (Webster & Sons, Ltd.), Montreal
F. W. White (McDougall's, Limited), Ottawa
Geo. H. Whitlock (Whitlock Marlett, Ltd.), Moose Jaw, Sask
Geo. H. Whitlock (Moose Jaw Board of Trade), Moose Jaw, Sask
R. Wright (Wright & Co. Inc.), Ottawa

business in connection with the reconstruction of France and Belgium. Another way of meeting the situation was by undertaking domestic works extensively. Railways were run down and factories suffering for lack of repair, and it was his belief that the business resulting from overseas and domestic reconstruction work would absorb a very considerable amount of labor and would be sufficient to maintain our prosperity. In regard to housing, Sir Thomas said that this was one of the most important questions brought up. It had been considered at the recent meeting of provincial premiers. He had seen some difficulty, however, in the Dominion government undertaking a housing programme throughout the country, but it was possible some project might be undertaken. At the recent meeting of the provincial premiers they had been advised if they needed financial assistance to deal with the situation, the Dominion government would supply it. The Minister said he was sure the government would be sympathetic with the representations as to the use of Canadian materials.

Hon. F. B. Carvell, Minister of Public Works, repeated his statement made at the luncheon the previous day, that the department would not hesitate to make expenditures on works which were reasonable and useful. As to the use of Canadian materials, it had always been his policy to adhere as closely as possible to this in the past. but he said that there was nothing in his department gave more trouble than procuring and using Canadian stone and marble. With regard to the letting of work under the Dry Dock Subsidy Act, he said that there seemed to be misunderstanding, the measure providing for the subsidizing of firms which proposed to build dry docks on submission of their plans and specifications, if the government thought advisable. In cases where the government itself built the dry-docks they called for tenders and prepared plans and specifications in the usual way. He was very much gratified with the proposal that all public works be let by public tender. Only twice since he had assumed his present office had that principle been diverted from.

Hon. Mr. Reid said that in his department he believed a great many men could be employed on the railroads, which had been allowed to run down during the last four years. He also stated that he was taking up the question of recommending canal works which had been closed down and that he hoped to submit a proposition to council to be proceeded with in the near future.

At the luncheon on Thursday afternoon Senator Gideon Robertson, Minister of Labor, and Mr. Thomas Moore, president of the Canadian Trades and Labor Congress, were guests and speakers. Other guests were Mr. H. B. Thomson, chairman of the Canada Food Board, and Dr. McGill of Winnipeg, who had been active in handling the grain which fed our allies during the war period, and Mr. H. Daley, director of the Repatriation and Employment Committee of the Cabinet.

Both Senator Robertson and Mr. Moore gave interesting and able addresses, urging the necessity of closer co-operation between employers and employed, with mutual recognition of each other's rights.

On Thursday afternoon, by courtesy of the Department of Public Works, the delegates were shown over the new Parliament Building by Mr. Pearson, the architect.

Number of Munition Workers Released

In response to an inquiry regarding the number of munition workers likely to be released in the immediate future we have the following reply from the Department of Labor:

"The best information available to-day is that in the Province of Ontario 26,857 men and 6,963 women it is definitely known will be deprived of their employment owing to munition factories reducing their staffs. In the Province of Quebec we have definite information that 17,148 men and 1,563 women will be in the same position.

"This does not represent the total number by any means, but does represent definite information obtained from 307 out of 430 industrial concerns engaged in the manufacture of war material, the remaining number being unable to say definitely whether they would be reducing their staffs or not.

"The total number for Canada definitely known is 56,894, of whom 48,115 are men, and it is assumed that this will represent less than one-half the total number of people so affected.

"The above is the best estimate that is available at the present moment."

Permanent Sub-Committee on Power

The Dominion Government has had under consideration a co-ordination of the activities of the various Dominion departments and branches, which at present have to do with power and the investigation and administration of water power matters. The Government has decided on the establishment of a permanent special sub-Committee on Power, to which all matters arising from time to time concerning questions of power, shall be referred. This Power Committee of the Cabinet consists of the Honorable Arthur Meighen, chairman; Honorable F. B. Carvell, Honorable J. D. Reid, Honorable N. W. Rowell, Honorable J. A. Calder, and Honorable C. C. Ballantyne.

As the chairman of this special committee is chairman of the Dominion Power Board, there has been effected direct and co-ordinated connection between the government and the various departmental agencies concerned in power matters. This should be conducive to adequate consideration and prompt action upon the many complex problems that will be confronting the Government from time to time with regard to the best method of utilizing the magnificent power resources of the country.

The Government's "No strike" order has been cancelled. The following announcement has been issued in this regard: "On the recommendation of the Minister of Labor, the Government has revoked the "No Strike" order-in-council, passed on October 11, 1918. The immediate necessity of the original order was caused bv a threatened strike, staged for Tranksgiving Day, by some 5,000 labor men. The order was not regarded by the government as placing any disability upon the great majority of labor organizations who had accepted the government's war labor policy, as announced by order-in-council in July last, and were submitting all their grievances to the tribuanals designated, which were being operated with perfect success. The "No strike" order was issued only for the purpose of maintaining industrial peace during the continuation of the war, and is cancelled because it has served its purpose and is no longer necessary."

Relation of Highways to Motor Transport Efficiency

By Arthur H. Blanchard, C.E.[*]

THE efficiency development of highway transportation through the means of the motor truck parcel post service, return load bureaus, inter-city freight delivery, rural express and other methods of motor transportation, necessitates the utilization of highways during 365 days of the year and the construction and maintenance of good roads everywhere.

The practical development of this programme calls for the expenditure of vast sums of money, at least one billion dollars annually. The cost of highways of the future is problematical. An indefinite period will elapse before the wages of labor and the cost of materials will be adjusted to normal conditions. These economic questions constitute a problem which must be given exhaustive consideration. One phase, upon which it is advisable for all to deliberate, is the sources of the unskilled labor so largely used in highway improvement. The world war has materially reduced the available supply in this country and the reconstruction of Europe will prevent the usual additions through the avenue of immigration. The belief is rapidly growing that the solution is the importation of Asiatic labor.

To-day there are in the United States 2,500,000 miles of rural roads, twelve per cent. of which are classed as improved. A conservative estimate would indicate that not more than one-fourth of one per cent. of the total mileage is suitable for motor truck trunk highway traffic. During 1917 there was appropriated for the improvement of rural roads $300,000,000. This work is under the jurisdiction of the Federal Government, the State Highway Departments, over 3,000 counties in the various states and the innumerable townships. The scope of this brief resume will not allow a discussion of the methods of financing highway improvement, but it is advisable to strongly emphasize the indisputable fact that it is reckless financing to construct roadway surfaces, which will have a life of ten years, with fifty-year bonds.

To-day there is no national system of highways in the United States comparable to the world-renowned national system of France. Indications point, however, to a rapidly developing sentiment and demand for the creation of a system of interstate highways aggregating between 50,000 and 150,000 miles, which shall be constructed and maintained under the supervision and at the expense of the Federal Government. Such systems of highways as we now have are practically developed through the individual or co-operative action of our state, county and township governments, federal aid constituting a very small percentage of the total amount expended. The development of systems in many parts of the United States is in a chaotic condition, due primarily to lack of foresight and wise administration, local jealousies, and ineffective laws.

Efficient and economical highway improvement has been seriously jeopardized in the United States through political interference and the placing of highway work in the hands of laymen who have had no experience in this important technical profession. Unfortunately the public neither appreciates the character of the duties of highway officials nor does it take proper interest in the expenditure of its funds. The people must be educated with respect to the complex work for which highway officials are held responsible and the waste of public funds directly attributable to having highway work in the hands of laymen. It should be emphasized that the primary objects of the educational campaign advocated are: First, the economical and efficient expenditure of the millions of dollars annually appropriated for highway work; and second, the appointment of members of the highway engineering profession to the innumerable positions of responsibility in public life which demand the combination of administrative ability, honest character, and the technical knowledge, training, and experience possessed by qualified engineers.

As in the case of many public activities, it is practicable in connection with this problem to derive valuable suggestions from practice in foreign countries. A review of their histories indicates that they have passed through the same transition period which we are entering. In France, many years ago, the people and the servants of the people realized the advantages accruing from the establishment of a permanent organization of efficient, well-trained highway engineers, and hence there was created the renowned Department of Roads and Bridges of France. Passing across the English Channel we find similar conditions in Great Britain. In order to secure a dollar's worth for every dollar expended the British public realized that it was necessary to have in control of their public works men trained in a profession directly dealing with every economic and engineering phase of public improvements. It has therefore inaugurated the practice of requiring that applicants for a given municipal or county position shall have attained the grade of membership in the Institution of Civil Engineers of Great Britain commensurate with the responsibility of the work of the particular office. Many leading municipal and county positions require that the applicant shall, first of all, hold the highest grade of membership in the institution, while positions in small counties, towns, and districts require, in many cases, associate membership. It would seem desirable in this country that a step along the line of English practice might be taken and, in the case of positions of highway officials, that there be incorporated in the constitution of a state or the ordinances of a city the stipulation that the applicant shall hold a certain grade of membership in the American Society of Civil Engineers, and have had a certain number of years of experience in highway work.

The problems confronting the highway engineer of to-day are entirely different from those which existed fifteen years ago. At that time, the motor vehicle was not a factor. To-day between five and six million motor vehicles use our highways, ten per cent. of which are motor trucks. Instead of constituting practically one hundred per cent. of the traffic, as in 1903, horse-drawn vehicles at present amount to five to twenty per cent. on highways outside of urban districts

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[*] President of the American Road Builders' Association and the National Highway Traffic Association, delivered on November 22, 1918, before the Conference on "Modern Methods of Motor Transportation" held under the auspices of the Colt-Stratton Company, 1847 Broadway, New York City.

With the enormous development of motor truck highway transportation, which this country is to witness in the next five years, many established practices in highway work must be remodelled. It is self-evident that the increased tonnage will call for ideal drainage, strong foundations and roadway surfacings suitable for motor truck traffic. In this connection may be cited the recommendation of the former New York State Department of Efficiency and Economy, in 1915, that all trunk highways should be built with cement-concrete foundations. Dependent upon the amount and character of the traffic to which a trunk highway will be subjected during the life of its surface and other factors influencing its selection, the following types are suitable: Bituminous concrete; cement-concrete; brick; and stone block.

As of particular interest to the advocates of the development of motor truck transportation is the present condition pertaining to the width of pavements on trunk highways. Reviewing the construction of the past few years of the types of pavements heretofore mentioned used on trunk highways, it is found that the widths vary from 12 to 18 feet with a few instances of greater widths. In this connection it is of value to note that the highway committee of the American Society of Civil Engineers recommended several years ago that "where motor truck forms a considerable portion of the total traffic likely to use a highway, the unit width of traffic lines should be considered as 9 or 10 feet, instead of 7 or 8 feet, as heretofore." Furthermore, as far back as 1908, the First International Road Congress, held in Paris, adopted this resolution: "There should be but one roadway for every kind of vehicle, 19 feet, 8 inches wide at least." It is, of course, well known that many of the main county highways of England have an improved surface of from 20 to 22 feet, and that the main trunk highways of France are practically 24 feet in width. When the rapid development of touring car, motor truck traffic and motor bus routes are given consideration, it is obvious that our important inter and intra-state trunk highways should have roadway width of not less than 20 feet.

Other factors in the construction of highways, which must be given careful consideration during the next few years, are strengthening of highway bridges, grades, location and alignment of highways, adequate guard rails, and uniform highway signs.

The people of the United States are beginning to appreciate the fact that in order that value is received for the money expended in the construction of highways it is necessary that the highways should be efficiently maintained. Some method must be devised by which the legislatures shall annually appropriate sufficient funds to properly and economically maintain improved highways. Legislature after legislature has followed the procedure of discounting the estimates submitted by Highway Departments. Hundreds upon hundreds of miles of highways are to-day improperly maintained due to lack of funds. It should be borne in mind that if maintenance is curtailed in one year in a given state to the extent of $500,000, and miles of highways are thereby left unrepaired, the appropriation required in the following year to repair the damage to the highways not maintained may amount to a million dollars.

It is of vital import that uniform highway traffic laws should be placed on our statutes. Such laws must cover the physical factors and the operation of all types of vehicular traffic. Laws will be based on available data and opinions. There are at present, innumerable investigations which should be made to ascertain facts pertaining to the inter-relationship of motor truck traffic and the durability and serviceability of highways. If highway departments do not conduct such investigations, they should be undertaken at once by motor truck interests. If the essential data is not available, naturally traffic laws will be based upon conservative conclusions reached by highway officials and members of our legislative bodies.

The Value of a Plan

The Municipality of the Village of St. Michel de Laval failed in its appeal from a judgment of the Superior Court ordering the payment of $2,250 to Messrs. Beique and Charton, civil engineers, for professional services rendered in the preparation of an official plan fixing the boundaries of the municipality. Plaintiffs claimed by their action payment of a sum of $2,800, but the municipality contested the amount beyond $500.

The question to decide was whether the municipality was right or wrong in its contention that the plan was a simple preparation in accordance with the provisions of Article 55 of the old Municipal Code. The court of first instance held that the contention was wrong and awarded plaintiffs $2,225, with costs.

The Court of Review now confirmed this judgment, maintaining that the work of plaintiffs had been more than the mere preparation of a plan. They had surveyed the principal parts of the municipality and prepared and drawn the plan for the incorporation of the municipality.

Its utility did not end there, Justice Lafontaine pointed out. "This plan," he said, "may be considered as the official plan of the municipality which, under Article 554 of the old Municipal Code, it would have a right to order made now that the municipality is in existence. In the circumstances, therefore, it seems to this court that there is no error in the judgment which is therefore confirmed, with costs."

It is understood that the Dominion Government has plans practically completed for the construction at Leaside of terminal buildings and headquarters for the Canadian Northern lines. A large amount of money is to be expended and employment given to many returned soldiers on this work. Reports state that an effort will be made to bring the district within the city limits of Toronto, and that Hon. Frank Carvell, Minister of Public Works, will make a proposition to the city in regard to the contribution of a substantial sum in lieu of the taxes to which the city would be entitled. It is said that the Department of Public Works and the Department of Railways and Canals are planning great development work in the district and it is the intention to make a more direct route for the C. N. R. trains entering the city.

Mr. N. J. McIlhone, Superintendent of Construction for Peter Lyall & Sons Construction Co., Limited, Montreal, died in Montreal last week, aged 46 years, after a weeks' illness.

The Engineer's Creed*

A GREAT military leader once said: "Duty is the sublimest word in the English language." Hence, the sublimest act of man is to do his duty, and the prerequisite of doing that sublimest act is knowing what duty is.

In the long ago children were taught the church catechism and in that catechism duty is defined: "What is thy duty toward thy neighbor?" "My duty toward my neighbor is to love him as myself and to do unto all men as I would they should do unto me." This definition is followed by other admirable suggestions, but taken by itself it contains the germ of true ethics; as the oak springs from its germ, the acorn, and becomes one of the noblest trees of the forest, so from this ethical germ a code expands to guide and direct both professional and lay people.

Moses brought down from Mount Sinai the tables upon which were writ the ten commandments; eight of these are prohibitive and begin "Thou shalt not," and their observance is wholesome to-day as when they were revealed to the tribes of Israel as they wandered in the wilderness. They designate the harm that one must not do to his fellow man, but do not suggest the good that one may do for or to him. After the promulgation of the Decalogue fifteen years elapsed before the good Samaritan answered for all time the question, "Who is my neighbor?" From "wells of ancient inspiration" we draw many undying truths and none of these is truer than this: "No man liveth unto himself." The fact of being a man establishes kinship to the human family, and utter isolation from all of the members of that family is impossible. The debt of service is a debt of honor, and how best to discharge that debt should be the desire and the effort of every honorable man.

This being true why should engineers need more than the common, everyday ethics of right living which are applicable to every avocation, calling, or profession?

The honesty which is unswerving,
The truthfulness which abhors a lie,
The helpfulness which lightens the burdens of life,
The human sympathy which gladdens aching hearts,
The honor which scorns to take a mean advantage,
The courage which always dares to do right, and
The courtesy of kindliness.

These are the branches which the germ of ethics sends out.

The engineer has obligations; a few of which may be referred to.

In accepting an engagement in any field of service in which he has not already proven his attainments to be equal to the task, he should be frank with his client and state just what his previous experience has been and give the reasons which, in his judgment, justify his undertaking the contemplated work. Many a man has had responsibilities thrust upon him by clients who, though fully aware of his lack of previous experience in the field which they wished him to enter recognized in him resourcefulness, good judgment, industry, and frank honesty, which they believed fitted him to carry the new responsibility to a successful issue; and not often has he failed.

The engineer, in responsible charge of construction work which is being done by a contractor, individual or firm, at once exercises two functions, one requiring engineering knowledge, skill and experience; the other judicial fitness. He becomes the arbiter between the principal, man, firm or corporation for whom the work is being done and whose money is paying for it, and the contractor who is doing the work. He must be a just judge, executing righteous judgment between the parties to the contract, without fear or favor. The fact that his client, the principal or first party to the contract, pays him must not have the value of a pennyweight in tipping the scale in favor of the source of his income. The engineer owes his client an allegiance demanding intelligent, conscientious, and diligent service. That he owes, but his debt demands for its liquidation no act, no word which would compromise his integrity or offend his sense of justice and right.

The engineer's obligation to serve is not limited to the duties for which he is paid; he owes it to his equals in service, to his subordinates, and to the public at large. His equals are his brothers with whom he should share his knowledge and experience, should they seek it. His subordinates should find in him the help of good example; the friend with whom they may take counsel, and the mentor who will impart of his knowledge of life, of men, and things, to aid them in shaping their conduct and their purpose.

To the public at large, he owes good citizenship. With every other citizen he shares responsibilities for government, civic, state, and national, and his efforts should be to make government good. He cannot hold himself aloof from those activities which our form of government imposes upon those who live under it, and escape responsibility for its shortcomings and its failures. If an unworthy man represents him in any governing body, he shares that unworthiness unless he exercised the right and duty of good citizenship and tried to put a good man into the office that the weak or bad man holds. "They also serve who only stand and wait" may be true of those who through misfortune are cut off from life's activities, but the saying does not apply to any live engineer. "He must be up and doing." He must keep his mental equipment as fit for service as the soldier keeps his arms, and the guiding motives of his life true, lest they fail him when the hour of trial comes.

Moreover, an engineer owes a professional obligation to the public by reason of his special training along technical lines. Therefore, he should use his knowledge and experience to promote the general welfare by every means in his power. He stands upon the watch tower of progress to warn against danger and to show the way to better methods in dealing with problems of engineering. He should stand against the individual or group of individuals who try to exploit, for their own profit or advantage, forces of nature which belong to the nation, the state or the municipality, without making a just return therefor to the rightful owners of the potentiality.

Wherefore should an organization of honorable men present a code of ethics when each carries in his own mind and heart rules of right living and honorable action?

It is "Lest we forget."

The law-abiding are not conscious of the restraints of the law, but the lawless are made to feel its power. A code of ethics accepted by the great body of professional men is the declaration of their faith, the chart by which they direct their course in the voyage of life. To this chart one who is in doubt may turn for suggestion as to the right course in any time of perplexity and by the principles laid down in this chart transgressors will be judged and disciplined by their fellows.

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*From the report before the American Association of Engineers, Chicago.

The Code

Any code of ethics must be predicated upon the basic principles of truth and honesty. "Whatsoever things are true, whatsoever things are honest," are the things for which engineers must contend.

An engineer may not "go beyond and defraud his brother" by any underhanded act or method. He may not do or say anything which will injure his brother's reputation or his business for the purpose of securing his own advancement or profit. This admonition carries with it no obligation to refrain from telling known and absolute truth about an unworthy brother, as a protection to others, but the truth so told must be such as can be substantiated, and he who tells it must have the courage which will not shrink from the consequences of his telling.

The engineer owes his client allegiance demanding his most conscientious service. But conscientious service to the client must never entail a surrender of personal convictions of truth and right.

An engineer who receives compensation from an employer may not receive gift, commission, or remuneration of any kind from a third party with whom he does business for that employer.

An engineer seeking to build up his business may not resort to self-laudation in advertising. He may state briefly the lines of work in which he has had experience and enumerate responsible positions which he has held and give his references.

An engineer who employs others, either in his own service or in that of the client who employs him, should recognize in his relationship to them, an obligation of exemplary conduct, of helpfulness, and personal interest in those with whom he is thus brought in contact, and he should discharge such obligation tactfully and kindly.

The honor of the profession should be dear to every engineer and he should remember that his own character and conduct reflect honor, or the reverse, upon the profession.

If, then, he so lives that his own honor shall never be smirched by his own act or omission, he will thus maintain the honor of the organization to which he belongs.

The question of erecting a bridge across the Niagara River as a connecting link between Canada and the States, in the vicinity of Buffalo, which has been forgotten in the urgency of war effort during the past four years, was again revived at a recent meeting of the Buffalo Engineers' Society. No definite project was advanced at this meeting, but a general discussion of great bridge spans in America was presented by Mr. Frank W. Skinner, C.E., of New York. His lecture was illustrated by slides showing views of the structures at Niagara Falls, Quebec and New York, both completed and during course of erection. Mr. Skinner said there were three possibilities for long span bridges shown at the various crossings of the Niagara Gorge. These were the suspension bridge, the cantilever bridge and the steel arch bridge. Of these, he considered the best for long-span construction would be the suspension bridge.

The Prevention of Longitudinal Cracks in Hard Surfaced Pavements

By Wm. C. Perkins

CAN longitudinal cracks in hard-surfaced pavements be prevented? Many brick and concrete pavements, especially in northern latitudes, develop unsightly cracks along the centre line of the pavement, which mar otherwise good pavements. These cracks may not lessen the durability of the pavement, and they are easily taken care of at small expense; but they are defects which we should endeavor to overcome by improved constructional methods.

The study of longitudinal cracks in hard-surfaced pavements has evolved several theories of causes. The generally accepted theory is that of pressure exerted against the under side of the artificial foundation by the freeing of water in the underlying subgrade. Undoubtedly other conditions, such as traffic or soft subgrade, might be either an efficient or a contributory cause of cracking; but in my opinion 90 per cent. of longitudinal cracks are the result of frost heavage.

How can this frost action be prevented? We have said in the past, "Drain! drain! drain! and more drain! Keep the subgrade dry"; and in our endeavors to keep subgrades thoroughly dry we have cross-drained, drained longitudinally, herringbone drained and drained the taxpayers' pockets, yet we have longitudinal cracks, many times directly over our elaborate system of drainage.

Underdrainage is unquestionably advantageous in lowering the water table, but present methods fail to keep subgrades dry, particularly in clay soils and in soils susceptible to capillarity. While our present drainage system does not prevent cracks due to frost action, it does tend to prolong the life of pavements. Nevertheless, in spite of drains a certain amount of water reaches the subgrade underlying and supporting the artificial foundation, and successive freezing and thawing, especially in the early spring of the year, causes upheaval of the subgrade. As explained in a recent article printed in certain engineering journals, as the pressure cannot go downward on account of the frozen ground, it must extend upward. This upward thrust breaks the pavement.

We do not know exactly how the pressure acts; we have not enough data on the subject to warrant positive conclusions. Undoubtedly, after the war, when engineers will have more time for research work, tests will be made to determine exactly how the upward pressure acts and how the resultant forces are distributed through the pavement. All we really know now is the result—a pavement cracked, usually along or near the centre.

Evidently the remedy must be found in a foundation design. Can we construct a foundation which will, either directly or in some measure, overcome the destructive action of frost?

As a means of accomplishing this purpose I suggest a foundation constructed as follows:

Upon the earth, or prepared subgrade, lay a course of two-duct tile 4-in. in height, outside measurement. The surface measurements could be any standard size, but I would suggest 8½ in. wide by 12 in. long. They may be made of any desired material, such as concrete, vitrified shale or clay, and of any shape or form.

Complete this foundation with 2 or 4 in. of concrete or other suitable material. We have then prepared a 6 to 8-in foundation upon which to place our wearing surface of any standard paving material—brick, block, concrete or bituminous.

By the use of the tile in the artificial foundation, we endeavor to minimize the force of the upward pressure of a frozen subgrade.

(1) The tile acts as a non-conductor of heat between the ground and the paving; the air within the ducts of the tile serving as a non-conductor prevents the extreme cold or frost from penetrating through the pavement of the sub-grade, and also prevents the escape of heat from the earth. In many sections this type of construction may prevent actual freezing of the subgrade, while in extreme northern sections it will materially reduce the freezing.

(2) When the earth, or subgrade, does freeze, notwithstanding the heat insulation of the tile, the force, or explosion, will be compensated by the air space and not be transmitted to the paving above. In case the tile be too strong to break under pressure of a frozen subgrade, the bottom of the tile, under the air spaces, could be "scored," thus providing a weak spot to break under this upward pressure. The superfoundation and the wearing surface would be sufficiently strong to bridge over the breakage of the bottom of the tile under the air-space sections, since the walls and partitions of the tile would remain intact and would afford ample support to the superfoundation.

(3) The tile would also act as drains to carry off any ground water or water drawn into them by capillary action, thus lessening the hazard of cracking due to the upward force exerted by frost in the subgrade.

The tile may be laid longitudinally, transversely or diagonally, the water would be carried to the curb or edge, where it could be taken care of by means of longitudinal drain or French drains of gravel or stone. If the tile were laid longitudinally the water could be taken care of at regular intervals by cross-drains of tile or by French drains of gravel or stone. The grade and cross-section of the improvement would determine these details.

It is difficult to estimate comparative prices in these abnormal times, but basing estimates on available data, the 4-in. tile should not cost more than 4 in. of concrete, in place, and if constructed as suggested, the tile and concrete foundation should be able to carry at least the same load as if the foundation were entirely of concrete or of a material of equal load bearing strength.

The type of foundation I have suggested as a means of preventing longitudinal cracking of hard-surfaced pavements is the result of study and experience, and while it has not been subjected to the final test of practical service under all kinds of climatic and traffic conditions, I have sufficient faith in its utility for the purpose designed to have the type of construction protected by patent.

The tentative programme of the meeting of the War Service Committee of the National Federation of Building Industries, which will be held in the Hotel Traymore, Atlantic City, December 6-7-8, is announced. Among the committees which it is proposed to appoint are the following: Returned Soldiers' Committee; Own Your Own Home Committee; Committee on Finance; Committee on Materials and Transportation; Committee on Commercial Arbitration; Committee on Business Ethics and Practice; Labor Committee; Referendum; Washington Representation and Executive Committee.

Croydon and Wolverhampton Sewage Disposal Experiments*

Croydon Experiments.—In connection with the question of utilization of sewage to the best advantage, some interesting work has been done at Croydon sewage farm during the last two years by Mr. J. E. Farmer, F.C.S. The policy adopted there is based on the principle that the solid matter in sewage deposits more nitrogen than mineral fertilizers. This being so, the soil new to sewage treatment would have a balance of mineral salts, and with the help of nitrogenous manure would produce heavy crops at first. If, however, owing to the long continued application of sewage, the nitrogen is added at a greater rate than its depletion by cropping, and without a corresponding increase of the mineral matters, which are also depleted by cropping, the soil eventually becomes out of balance for heavy crop production. The operations at Croydon which consisted of the application of artificial fertilizers, lime, basic slag, etc., in order to restore this balance, resulted in doubling the yield, and have been financially successful. I believe this is the first sewage farm where a systematic and scientific use of artificial fertilizers has been tried to restore the balance of mineral and nitrogenous matters in the soil.

Experiments at Wolverhampton.—Experiments have been carried out recently by Mr. Wm. Clifford, M. Inst. C. E., of Wolverhampton, in order to determine the type of tank best adapted for sedimentation of sewage, and to prevent the short circulating and eddies which all who have tried by means of a color test to time the passing of a liquid through a tank have no doubt observed. The underlying principle of Mr. Clifford's experiment is to dissipate the energy of the incoming sewage, and bring it to rest in the shortest possible time, to prevent eddies, and to ensure that all the sewage received into it should remain for an equal period of time in the tank. The large number of exhaustive experiments carried out were of remarkable interest, and resulted in the design and construction of the sedimentation tank used in connection with the activated sludge system at Withington, Manchester, which so admirably fulfills these functions, notwithstanding the fact that activated sludge contains much flocculent matter, and is particularly sensitive to any variation of rate of flow, or increased velocity due thereto. Briefly described, this tank is of the Dortmund type, its essential feature being in the method of feeding adopted. The sewage passing down a central pipe is discharged into a circular vessel of somewhat larger diameter. Outside this a guard chamber is constructed, the dimensions of the tank, the vessel and the guard chamber are so proportioned that eddies are prevented, and the energy of the incoming sewage is effectually dissipated.

The Northern Construction Co. have completed work on the section of the P. G. E. Ry. extension between Clinton, B.C., and 59-Mile House, and are now laying track from 59-Mile House to a point 6 miles north of Horse Lake Summit. When this is completed track-laying will be suspended for the balance of the winter, but operations will be carried on in deepening cuts. Steam shovels will be kept at work throughout the winter.

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*From the presidential address of Mr. Edward Wilcox to the Association of Managers of Sewage Disposal Works

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Batiscan, Que.
Department of Public Works, Ottawa, contemplate construction of sea wall 2,000 feet long from Leboeuf wharf to property of J. Leveille.

Orillia, Ont.
James, Loudon & Hertzberg, Ltd., Consulting Engineers, Toronto, have been employed by the Town Council to make a road survey of the Town, preparatory to the letting of contracts for some five miles of pavement next year.

Pembroke, Ont.
By-law will be submitted for raising of $50,000 for construction of waterworks costing $42,000 for Town Council. Engineer, W. J. Moore.

Sarnia, Ont.
By-law is to be submitted in January for construction of 24 in. intake pipe in ninety tons of cement costing $10,000, also building of screens and pump house, and installation of motor driven sludge pump. Engineer, H. F. Hall.

Squamish, B.C.
Department of Public Works, Victoria, contemplates improvements to waterworks system. Engineer, A. E. Foreman, Victoria.

Toronto, Ont.
York Co. Highway Commrs. contemplate expending $300,000 for good roads during 1919. Engineer, E. A. James, 57 Adelaide E.

CONTRACTS AWARDED

Cap De La Madeleine, Que.
1½ miles of water and sewer pipes to reach buildings now under construction for St. Maurice Paper Co.: General contractor, La Cie D'Aqueduc De Cap De La Madeleine.

Steveston, B. C.
Work is to start for protective works for Department of Public Works, Ottawa: General contractor, Hodgson & King, 626 Pender St. W., Vancouver.

Railroads, Bridges and Wharves

Arnprior, Ont.
Department of Public Works, Ottawa, contemplate construction of wharf and dock.

Nominingue, Que.
One mile of track has been laid for narrow gauge railroad seven miles long, costing $35,000 for Eugene Patenaude. Engineer, Mr. Beique, C.I., 120 St. James St., Montreal.

North Vancouver, B. C.
City Council contemplate construction of dry dock and repairs to bridge. Clerk, R. F. Archibald.

Prince Rupert, B.C.
Tenders are being received by minister, Hon. Dr. King, until noon, December 10th, for Cow Bay Launch Harbor protection work for Department of Public Works, Victoria.

Salmon River, B.C.
Tenders are being received by minister, Hon. Dr. King, until noon, December 12th, for two bridges, one at Sacks Crossing and other at Second Crossing, for Department of Public Works, Victoria.

Three Rivers, Que.
Three Rivers Shipyard Ltd., 570 Notre Dame St., contemplate construction of three piers costing $15,000. Engineer, H. L. Clifford.

Trenton, Ont.
Tenders close December 14th for removal of old piers and construction of seven new concrete piers for bridge at Trent River crossing near Glen Rose for C. N. Rly. Engineer, A. F. Stewart, 68 King E., Toronto.

Vancouver, B. C.
Tenders will be called shortly for erection of transfer slip, west of pier A, costing $60,000 for C. P. Rly. Gen. Supt., F. W. Peters.

Board of Harbour Commissioners, 712 Pender St. W. contemplates construction of terminal railway to connect Government wharf with C. N. R. or Gov't. Rly. System.

Yahk, B.C.
Plans are in progress for extensive railway developments for C. P. Rly., Montreal, Que. Twelve mile branch of railway will be built from here to Meadow Lake.

CONTRACTS AWARDED

Hamilton, Ont.
Addition to dock costing $20,000 for City Council: General contractor, Canadian Engineering & Contracting Co., Depew St.

Quebec, Province of
Repairs to Matapedia bridge for Department of Public Works, Ottawa: General contractors, John C. McLean and Jas. A. Reid, Charlo Station, N.B.

Vancouver, B. C.
Extension to wharf for Defiance Packing Co., 510 Hastings St. W.: General contractor, Fraser River Pile Driving Co., Front St., New Westminster.

Public Buildings, Churches and Schools

Alberta, Province of
The Architectural Department has prepared three types of plans for hospitals, and the following places consider erection: Bassano, Big Valley, Bow Island, Cardston, Coronation, Drumheller, Hanna, Innisfail, Innisfree, Islay, Lacombe, MacLeod, Olds, Stettler, Taber. Architect, R. P. Blakey, Parliament Bldgs., Edmonton.

Burlington, Ont.
Tenders are being received by R. C. Desrochers, secretary of Department of Public Works, Ottawa, until noon, December 6th, for construction of active treatment ward in military hospital.

Ganges, B. C.
Tenders are being received by Minister, Hon. Dr. MacLean, for erection of "Ganges" school for Department of Public Works, Victoria. Architect, A. E. Foreman, Victoria.

Hamilton, Ont.
Tenders will be called shortly by architect, F. W. Warren, Bank of Hamilton Bldg., for erection of two storey, brick church costing $15,000 for Ebenezer Hall, Barton & Ruth Sts.

Kingston, Ont.
Tenders are being received until December 9th for construction of one-storey, frame T. B. pavilion for Department of Public Works, Ottawa. Architect, R. C. Wright, Robinson Bldg., Ottawa.

Mannville, Ont.
Tenders are being received by sec.-treas., G. M. Cundal, until noon, December 10th, for erection of municipal hospital for District of Mannville.

Regina, Sask.
The Commissioners of the City have appointed special committee to consider erection of auditorium, comfort station, police station and bridge or subway on Hamilton St., also repairing wooden water mains in various parts of city with cast iron pipe and extension of sidewalk system.

South Vancouver, B.C.
Municipality contemplate addition and alterations to fire hall costing $4,000. Commissioner, F. J. Gillespie.

Toronto, Ont.
Separate School Board has considered proposal to issue debentures for erection of schools in five parishes. Secretary, J. G. Hall, 65 Bond St.

St. Monica's Anglican Church contemplates erection of church. Pastor, Rev. Robt. Gay, 88 Prust Ave.

Vancouver, B. C.
Dominion Government will vote large sum at next session for port development work including the erection of buildings. Owners, Dominion Government and Harbour Commissioners, 712 Pender St. W.

Victoria and Saanich, B. C.
Victoria and Saanich Councils contemplate public recreation park with buildings.

Wadena, Sask.
Rural municipalities of Kelvington, R. M. No. 366, Sasman, Lakeview and

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A New Era for the Builders of Canada

THE recent conference held in Ottawa, by the leaders in the building interests in Canada, resulted in the organization of the Association of Canadian Building and Construction Industries. This organization is the first step in the co-ordinated development of one of Canada's most important industries, an industry that ranks second only to agriculture in the amount of labor employed.

The conference was most successful in every respect, due to the thorough and intelligent preliminary work of the men behind the movement, under the able direction of Mr. J. P. Anglin, of Montreal, and if the enthusiasm developed in the preliminary stages can be maintained it means the opening of a new era for the construction men of Canada.

The ills of the contracting profession are legion and they have been suffered in silence for years as more or less necessary evils. The new association offers an opportunity for concerted effort in the elimination of these afflictions. Heretofore, comparatively speaking, the contractor had no standing. He did not command the same respect in his community as did the professional or business man in other vocations. The attitude of the public seemed to be that the contractor was in business for the purpose of putting something over somebody. In no other business is it true that there is a buyer, a seller and a watch dog. The architect has a place in the building world. His proper sphere is to plan a building and see that the plan is executed. It should not be to watch for crooked work, to count the sacks of cement used and then accuse of intent. In many instances the builder is at the mercy of a watch dog authorized by that builder in the specifications he signs, to tell him how to proceed in the work of construction. Such a procedure is an insult to the profession. It could not occur in a profession that had standing. It occurs to builders because of the supposition that the owner or one of his clerks knows more about the erection of the building than does the contractor. Besides, in the opinion of many, most contractors are crooked, so there you have the standing of the profession.

Another serious ill of the profession is that the contractor's compensation is often too small in comparison with other businesses or professions. True, in the past were many days of big profits, but these are things of the past.

Contractors give the impression of being poor business men in that they sign contracts that are eminently unfair, that have been devised without representation of the contractor's interests, that place them at the mercy of a third party hired and paid by the owner. They have done so without protest, with the excuse that if they didn't accept the work on that basis, a competitor would. Contracts often specifically state that written orders must be received for any alterations and extras, and many a dollar is lost by failing to comply with those terms. The builder uncovers mistakes in plans and then is, almost invariably, the goat.

The business savors too much of a gamble, and too little of the scientific cost analysis. Until we get the gambling out and real cost systems in, bankruptcies which are a constant source of injury to the profession, will continue.

The builders' craft is the oldest in the world. It began when man first built for himself a shelter in the trees. Therefore builders should be justified in taking pride in their profession. Contracting is a real man's game and it takes a real man to play it successfully, but no other business presents such a complexity.

The aim of the contractor should be to turn out better products. The more the builder puts the stamp of quality in his work, the better the reaction on his profession. The more the public is educated to quality, the harder the course of the shyster, who operates in this profession as in all others. If the public knows a good job, the shyster is certain to create sentiment against himself. Place your own business practice above reproach and then get after the unscrupulous. Educate him to your own standards or hound him out by making the continuation of his practice impossible. Exposure is a sure cure for foul practice.

At present anyone with nerve and the first instalment on equipment can call himself a builder. To be a contractor will mean more when it is a little more difficult to enter this profession.

It was stated at the conference that deferred building in the leading cities of Canada during the last three or four years would amount to at least $100,000,000 per year, and taking Canada generally, deferred construction might be fairly estimated at at least $500,000,000, and perhaps one might safely say one billion dollars. This condition presumes increased activity and means prosperous times for Canada.

In view of this anticipated activity in the construction field, this national organization was most timely and should, undoubtedly, promote and finally establish, a new standard in the various phases of construction enterprise. The affiliation and co-operation of all existing Builders' Exchanges is most desirable and should result in great benefit to the national organization as well as the individual exchange.

The selection of the executive of the association by geographical location, embracing every section of the Dominion, will result in a much broader viewpoint than would otherwise obtain. One section will be fully advised as to existing conditions in any other section of the country and all will be able to work in unison and harmony for the betterment of the association, and industry and, most important of all others, for the progress and development of Canada.

Many points of vital interest were discussed from every angle, and many recommendations were made, such as that the Department of Public Works be asked to commence operations on all delayed public works as soon as possible; the use of Canadian materials wherever possible; that the Government call for tenders in the usual way in stated plans and specifications for all works let under the Dry Dock Subsidy Act; the granting of substantial aid by the Government for the purpose of constructing permanent roads and that such work be let by tender; that all Government, municipal, railway and corporation work be let and executed under statutory form of contract. Other questions taken up were the possibility of restriction in the supply of building materials; the need of unifying and codifying the various acts in force in the different provinces in connection with workmen's compensation; the need of a uniform system of building by-laws all over Canada; labor conditions; and industrial housing. It is readily apparent that any organization of this kind, to be of any use, must be alive. There is no halfway stop between success and failure. To be successful will require a maintained interest among all members, harmony and co-operation, a subjugation of self in the general interest of all, an intelligent study of every contingency that will arise and an unlimited amount of hard work.

It is a cause of great satisfaction that, not only has one comprehensive national organization been formed, but that the three sections—general contractors, subcontractors, and supply men—have established distinct and separate organizations within the parent association. For each section has problems and interests peculiarly its own, which each must handle for itself, and regarding which each should have complete autonomy. Particularly are the general contractors to be congratulated for at last gettitng together after having suffered so long and so severely through lack of unity.

Government Offers Financial Assistance to Solve Housing Problem

THE recognition by the Dominion Government of the necessity of granting financial assistance to aid in remedying the housing situation is shown in a decision to create a housing fund amounting to $25,000,000. It will be necessary for the provincial and municipal governments to develop a practical programme under their own management or interest and arrange for private organizations to take advantage of the Federal offer. The Government undertakes to provide this money and lend it to the provinces at the rate of 5 per cent. on provincial securities. The Ontario Government has already arranged to lend money up to the amount of $2,000,000 to municipalities for housing purposes, but under the new arrangement an amount totalling about $10,000,000 will be available if this province applies for its share of the Dominion loan.

The arrangement under existing legislation is that the Federal Government will lend money to the provinces, the provinces will lend it to the municipalities, and the municipalities, which take the ultimate financial responsibility, are, or will be, empowered to guarantee the bonds of housing companies. It is the duty of the municipalities to see to the organization of housing companies, and it is hoped that the official machinery will be provided at an early date. There is no time to lose. The houses are needed and needed badly, land is available, and the money forthcoming—why delay? How real the house scarcity in the City of Toronto is, for example, is revealed in the Toronto Housing Commission's report, just published, which says:

"A survey of 13,574 houses, in 14 representative districts, was made in order to determine in how many of these two or more families were housed. All these houses were constructed as single family houses, and the 48 apartment houses and 271 common lodging-houses were eliminated from the investigation. The dwellings under observation were found to contain 18,122 families, embracing 90,272 persons. In 4,383 homes, which contained 4, 5, 6, 7 or 8 rooms, there were two families. In 402 houses there were three families or more, and in 3,954 homes, in addition to the regular families there were lodgers. Thus, out of 13,574 homes originally intended as single family houses 8,739 contained 2, 3 or more families or lodgers, and only 4,835, or 36 per cent., were occupied by single families, for which the houses were built. Moreover, as shown by this particular inquiry, there were no less than 1,538 dilapidated houses, that is, houses unfit for habitation, included in the 13,574 dwellings visited."

While in 1912 there were 5,675 permits issued, or nearly 14 for every 1,000 of population, the number in each succeeding year up to 1917 shows a decrease, and in 1917 only 926, or but 16 per cent. of those issued in 1912 were recorded, though the population had increased over 56,000.

During the four years 1910-13 there were 22,061 marriages recorded in the city and 21,074 house permits issued—practically one for every marriage. In 1914-17, with 21,918 marriages the number of house permits was 6,334, or less than 29 per cent. of the marriages. In addition to this, no provision has been made for new families moving into the city.

Many of those who left Toronto for overseas as single men will bring back wives, while others will marry shortly after they return, thus creating a heavy new demand for small houses and apartments.

The Health Department has during the war relaxed its campaign for the closing of insanitary houses, but enough sanitary housing should now be provided to permit a resumption of the "drive" against overcrowding and insanitary conditions, "which tend to promote immorality and disease and constitute a menace to the community which cannot be too strongly censured."

In reply to inquiries by the committee as to how many citizens were in actual need of housing accommodation, 350 replied that they were immediately desirous of obtaining homes

Reinforced Concrete for the Construction of Ocean-Going Steamships

By F. G. Engholm*

THE total deadweight tonnage of reinforced concrete ocean-going steamships and barges under construction likely aggregates, together with orders actually placed, over six hundred thousand. It is probable that a very large proportion of this tonnage will be afloat by midsummer, 1919. The largest of these ships, 7,500 deadweight tons, are under construction for the Emergency Fleet Corporation, U. S. A.

Considering that the first real effort receiving strong financial backing only commenced about midsummer, 1917, the progress appears to be promising and also far-reaching. Reinforced concrete ships are being built to a considerable extent in China, Turkey, Spain, Italy, Germany, Norway, France, England and the United States.

The years of 1917 and 1918 have witnessed a truly remarkable development in reinforced concrete ship building. The majority of people seem to regard this development as being entirely new, no doubt due to the fact of their unfamiliarity with the material. It seems almost incredible to them that reinforced concrete is eminently suitable for ship building purposes. The fact remains, however, that the first concrete vessel was built nearly seventy years ago and still remains in perfect condition. For a period of some forty years after the completion of this pioneer vessel nothing seems to have been done to develop the ideas of its creator.

It is interesting to trace the development of reinforced concrete ships and the following table gives brief particulars of the principal vessels constructed and in service from 1849 till the present date.

Year.	Country.	Particulars.
1849	France	Rowing boat, 10ft. long, built by M. Lambot, at Miravel, France. Shown at Paris Exposition of 1855, and reported upon by the French Admiralty. Still in use and in excellent condition.
1887	Holland	Canal barges of 11 tons deadweight capacity, followed by others of 55 tons capacity. Having had several collisions with large ships and been frozen in the ice each winter, the first barge is still in regular service and in good condition.
1890	Central America	Rowing boat, built at Sonsonate, Salvador.
1897	Italy	Pontoon, on the Tiber, 65 ft. in length, by 21 ft. wide.
1899	North America	Schooner, 65 ft. long, 16 ft. beam and 14 ft. deep, built for North Atlantic coasting trade. Once driven on rocks off Cape Charles and got off uninjured.
1905	Italy	Between 1905 and 1912, the firm of Carlo Gabellini, of Rome, built over 80 concrete vessels, including barges of 150 tons deadweight capacity, pontoons for floating bridges and a steam collier.
1906	France	Barge, on River Lozere, 50 ft. long, 13 ft. beam and 3 ft. 4 in. deep.
1909	Germany	Lighter, of 220 tons capacity, built at Frankfurt-on-Main.
1909	Germany	Motor boat, for pleasure purposes.
1909	Holland	10-ton boat, built at Amsterdam.
1910	Holland	Motor launch, 50-ton lighter, 63 ft. 4 in. long by 15 ft. 9 in. beam, built at Amsterdam with double walls; 60-ton lighter of similar design, also built at Amsterdam. Several canal barges built in Holland about this period.
1910	Canada	Barge, 80 ft. long by 24 ft. beam, deadweight capacity 200 tons. Built in Ontario for use on the Welland canal. Has been in continuous service for eight years, having cost very little for maintenance, and remaining in good condition.
1910	United States	Lighter of 525 tons, built for service in the port of San Francisco.
1910	United States	Three dredging barges of 140 tons capacity, 64 ft. long by 24 ft. beam, built for use on the Panama canal.
1910	Brazil	Barge, built for the port of Bah Several others built in succeeding years.
1910	Belgium	Several motor boats of 100 tons capacity, 86 ft long by 14 ft 9 in beam by 7 ft. deep.
1910	Dutch East Indies	Vessels built in this and succeeding years include lighters of 90 to 180 tons, motor boats up to 60 ft. long, pontoons and canoes of various sizes.
1911	United States	Lighter of 86 tons capacity, for service in Chesapeake Bay.
1912	Italy	Barge constructed in this year stated to be in perfect condition and quite watertight, after six years' continuous service.
1912	United States	500-ton lighter, 113 ft long by 29 ft beam by 10 ft 6 in. deep, built at Baltimore for coal, sand and gravel transport.
1912	United States	Fleet of lighters, 100 ft. long by 30 ft. beam, for service in San Francisco Bay.
1912	Germany	Sailing vessel, built at Dresden.
1912	England	Pumping lighter, 200 tons deadweight capacity, 100 ft. long by 28 ft. beam by 8 ft. 6 in. deep, built on the Manchester Ship Canal and in perfect condition after continuous service for six years; only trifling expense in maintenance. The hull is a series of watertight compartments.
1913	United States	Lighter of 300 tons capacity, built at Baltimore. The owners stated in July, 1918, that the vessel had been satisfactory in every way and had not required a dollar's worth of repairs since being placed in commission.

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*Reinforced Concrete Engineer, Toronto. Associated with Francois Hennebique, Paris and L. G. Mouchel and Partners, London, Eng.

Year.	Country.	Particulars.
1914	United States	Two pontoons, built for service on the Panama Canal; length 120 ft., beam 28 ft., depth 8 ft. These and a number of smaller pontoons built later, are employed as landing stages for boats up to 65 ft. in length.
1914	Australia	Pontoon of 800 tons displacement, 108 ft. in length, built for the harbor authorities of Sydney.
1914	United States	Motor launch, built on Iron River, Michigan, and used there until 1917, when it was presented to the Chicago Naval Reserves.
1915	United States	500-ton lighter, built by the Chesapeake Barge Co., in Chesapeake Bay.
1915	Norway	Pontoon, 53 ft. long by 16 ft. wide by 7 ft. deep, built at Porsgrund.
1916	United States	Four landing stage pontoons on the Panama Canal; length 120 ft., beam 28 ft., depth 8 ft.
1917	England	Motor boat, built on the Thames.
1917	France	Barge of 700 tons deadweight capacity, 150 ft. long by 26 ft. beam by 10 ft. deep, built on the River Seine.
1917	France	Barge of 300 tons deadweight capacity, built for the French Government as a coal barge.
1917	France	More than twenty barges completed and put in commission by the French Government.
1917	Canada	Screw steamship of 350 tons capacity, launched at Montreal, in November; length 126 ft., beam 22 ft. 6in., draught 6 ft.
1917	Norway	Lighters and ships of 200 tons capacity and upwards, laid down at Moss, some being stated to be in service between Norway and Great Britain.
1917	Norway	Motor boat of 200 tons capacity and 80 horse-power, built at Porsgrund.
1917	Denmark	Lighter of 500 tons capacity.
1917	Sweden	Barge of 200 tons capacity, built at Malmo.
1918	England	20-ton motor boat, 40 ft long, 8 ft. 6 in. beam and 4 ft. load draught. Fitted with 25 horse-power motor and designed for a speed of 7 knots an hour.
1918	England	Canal barge, built in the Midlands, 70 ft. long by 6 ft. 11 in. beam by 4 ft. deep, 28 tons deadweight capacity.
1918	England	Sea-going barge of 400 tons deadweight capacity, 150 ft. long by 25 ft. beam.
1918	Scotland	Skiff, built at Montrose, 12 ft. long by 4 ft. 2 in. beam by 2 ft. 9in. deep.
1918	France	Cargo motor boat of 450 tons deadweight capacity, 152 ft long by 26 ft. beam by 12 ft. 6in. deep, fitted with two engines of 165 horse-power. Used in the Channel service for coal transport.
1918	France	Motor ship of 1,000 tons deadweight capacity, fitted with 400 horse-power engines, length 185 ft., beam 34 ft., depth 19 ft.
1918	France	Barges of 1,000 tons deadweight capacity to the number of 700 have been officially reported to be under construction and projected for the French Government.
1918	France	Steamtugs to the number of 50 are stated to be included in the programme of the French Government. Several steamtugs have already been built on the Seine and elsewhere.
1918	France	Sailing vessel of 600 tons displacement, fitted with motors, built at Marseilles.
1918	Spain	Motor ship of 450 tons displacement, 113 ft. long by 24 ft. beam by 11 ft. 6 in. deep, fitted with sails and 120 horse-power Diesel engines, built at Barcelona.
1918	Norway	Motor ships of 600 and 1,000 tons capacity, built for the North Sea trade.
1918	Germany	Motor barge of 70 tons capacity, 65 ft. 6 in. long, 14 ft. 6 in. beam and 5 ft. 6 in. draught.
1918	United States	Barge of 700 tons capacity, 112 ft. long by 33 ft. beam by 3 ft. 4 in. draught. Built in New York.
1918	United States	Steamship "Faith," 5,000 tons deadweight capacity, built at San Francisco and now engaged in ocean transport.
1918	United States	Fifty-eight 7,500 and 3,500-ton steamships authorized by the U. S. Shipping Board.
1918	United Kingdom	Barges of 1,000 tons deadweight capacity are now completed, ready for launching at several shipyards in England and Scotland, and good progress has been made in the construction of other vessels of the same class, as well as of steamtugs of 750 horse-power, and cargo steamships of 1,150 tons deadweight capacity. It is officially stated that the programme of the Department of Merchant Shipbuilding provides for the construction of about 200,000 tons of concrete vessels, apart from steamships, barges and other craft for private ownership.
1918	Singapore	Railway ferry-boat for transport of goods trains across the Straits; gross displacement, 500 tons; length 125 ft., beam 27 ft., moulded depth 8 ft.
1918	China	Motor boat launched at Shanghai, 65 ft. long by 15 ft beam by 6 ft. 7 in. deep.

The foregoing historical summary has been compiled from data given in the papers contributed to engineering and ship building institutions in Great Britain, America and France, and from particulars given in numerous technical journals. This is not a complete record of reinforced concrete ship building, but it nevertheless serves the purpose of demonstrating conclusively the world-wide employment of reinforced concrete as a standard ship building material, and the fact that the new branch of the industry is built up on the sure foundation of practical experience, gained during a period of at least 30 years. This progress has been made in spite of many obstacles.

To fully understand the status of reinforced concrete as a structural material we have to investigate the basic conditions which underlie its relation to other building materials.

Structural steel and clay tile are finished manufactured products which are sold to the contractor to erect in place, reinforced concrete is on an entirely different basis. The factory for producing reinforced concrete is right on the building site, and the manufacturer is really the contractor. The value of materials merchanted to the contractor, in making up a cubic yard of reinforced concrete, is very small.

Let us analyze the cost of a cubic yard of reinforced concrete. The following diagram (Fig. 1.) gives graphically the division of cost.

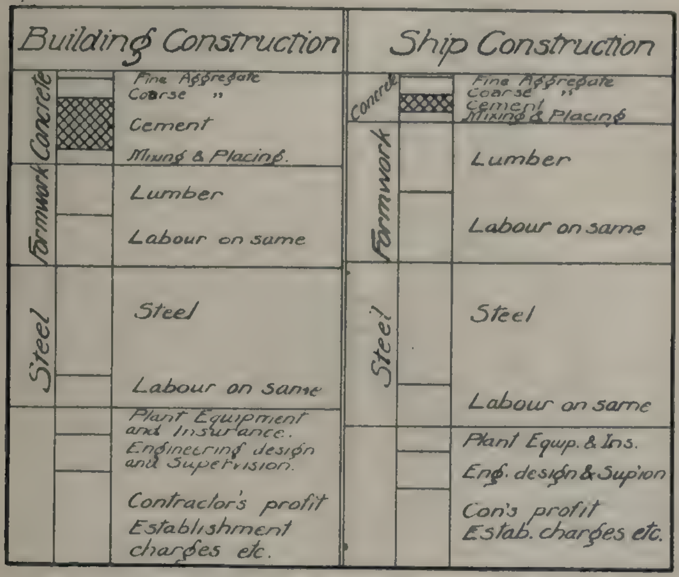


Fig. 1—Analysis of Cost of One Cubic Yard of Concrete

Let us consider the interest of the merchanting of materials involved in the use of reinforced concrete.

Stone, sand and lumber merchants do not have sufficient at stake to induce them to take any action in furthering the use of reinforced concrete. The steel used for reinforcing concrete is the cheapest form of manufactured product. Every pound of reinforcing steel sold on building construction stops the sale of more than three times the quantity of structural sections to effect the same purpose.

The sale of reinforcing steel, consequently does not appear to have received the support of the steel interests that it merits, if we except possibly a certain amount of advertising by merchants of patent deformed bars for reinforcing concrete. Though advertising reinforced concrete has been, and is now to a certain extent, carried out by these steel merchants, it does not represent a backing comparable with the efforts made in the merchanting of other building materials.

Cement is really the only finished manufactured product which is almost entirely dependent on concrete for its use. The cement manufacturers are organized in their efforts to further the use of reinforced concrete, and they advertise extensively. The plant required for the manufacture of cement compares in cost and complexity with that required to manufacture steel.

Let us consider a comparison of the cost of plant involved in the manufacture of cement, steel and clay tile.

The cost of the plant reduced to the unit basis of one barrel of cement per annum represents a capital of about $3.00. In the same way, the plant required to manufacture steel can be valued at $40 per ton per annum, and clay tile about $350 per thousand cubic feet per annum.

Now, let us consider a building of, say 1,000,000 cubic feet. The quantity of material used, if constructed in reinforced concrete, will be, say 2,900 cubic yards. If constructed in steel "fire proofed" clay tile, the quantity of material will be, say, 1,000 tons of steel; 93,000 cubic feet of clay tile.

One cubic yard of reinforced concrete is, therefore, equivalent to 690 lbs. of steel and 31 cubic feet of clay tile.

The value of the interests represented by the steel works and clay tile manufacturers will, therefore, be more than four times the interests represented by the cement works.

Similarly in ship construction—consider a ship of, say, 3,000 to 4,000 dead weight tons, one cubic yard of reinforced concrete is equivalent to about 1¼ tons of steel. The interests in this case represented by the steel works are more than eight times the interests represented by the cement works.

One has also to consider the total value of materials merchanted. The total value of the cement sold per cubic yard of concrete will be in the neighborhood of four or five dollars, whereas the equivalent value of structural steel and clay tile merchanted will be about $55.00, or eleven times the value in the case of ordinary building construction. In the case of ship construction, the value of structural steel merchanted will be about thirty-five to forty times the value of the cement.

The "manufacture" of reinforced concrete requires the supervision of experts, just the same as any other manufactured product.

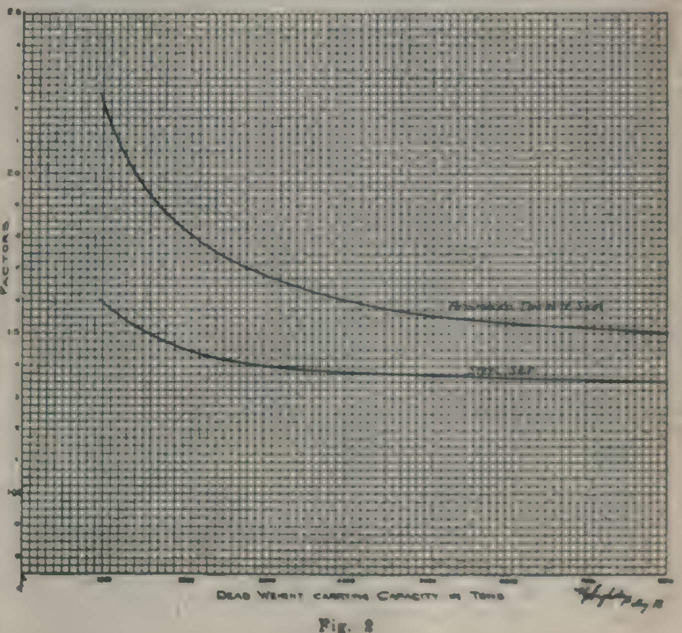


Fig. 2

Reinforced concrete is not purchased like any other manufactured article, the purchaser seldom tests what he buys. The tests are expensive and awkward to carry out.

The purchaser should employ and rely on an expert to supervise the work, to see that he is getting what he is paying for.

The public have failed to recognize this most important point, and as a rule no provision is made for the employment of such experts. The work of design and supervision of reinforced concrete was and is now often left to those having little practical experience.

This, together with the lack of commercial backing, has rendered the path of progress for reinforced concrete rough and stony, and it is certainly high time that some of the rocks obstructing the progress should be removed. The commercial public well receive great benefit if such an effort is made.

The progress of reinforced concrete construction is absolutely hampered by the lack of interest and a proper understanding, and by the unnecessarily restrictive clauses in Building Acts, By-laws and Regulations which abound in Canada and the United States.

There has been a growing tendency on the part of local Government authorities, municipalities, etc., to encroach more and more upon the province of expert, reinforced concrete engineers.

We find ourselves hampered in the exercise of our scientific knowledge and skill in the design and erection of all classes of reinforced concrete structures.

Instead of confining themselves to the formulation of simple and concise rules dealing with the requirements necessary for guarding the safety of the public, those responsible for the preparation of the by-laws have developed the unfortunate habit of fixing the dimensions and proportions of materials to be employed, and attempting to instruct professional men in the exercise of their duties.

As a typical instance, one of the chief features of the rules and calculations that has been adopted is the basic assumption that concrete and steel are separate materials and the mechanics of these materials have been considered separately.

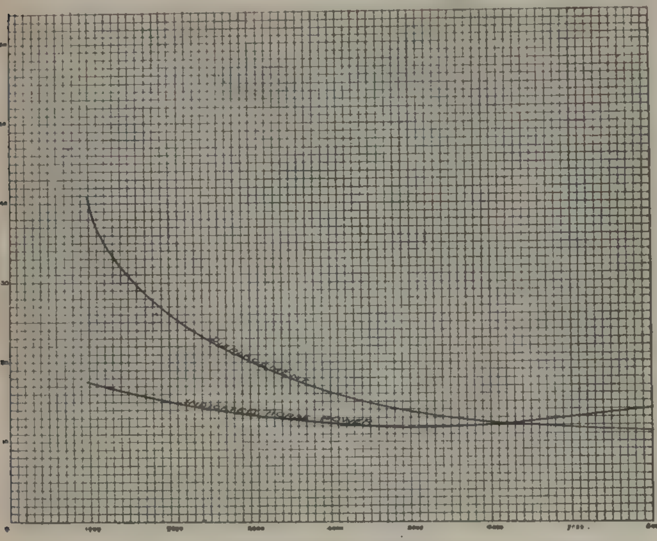


Fig. 3

In reinforced concrete construction, these two materials are combined together as one material.

To think of them separately, and to consider them separately, is a false condition and the conclusions derived therefrom are wrong.

Considering this, take one instance:—

In the design of compression members in reinforced concrete, and, in fact, wherever steel is used in conjunction with the concrete to resist compressive stresses it is customary to consider the modular ratios of concrete and steel—usually termed N.

While the modulus of elasticity for steel is fairly constant for all qualities of steel, the corresponding modulus for concrete varies considerably, its value varying with the differences in quality and proportions of the materials and their manipulation, and also with the stress.

Taking the steel equal 30,000,000, and 1,2,4 concrete equal 2,000,000, it gives a ratio of N. equal to 15. This means that we have a block of concrete, and a separate bar of steel exactly the same length and compressed the same amount—that is their respective shortened lengths be equal. If the stress on the concrete be 600 lbs. per sq. in. the stress in the steel will be 600 x 15 equals 9,000 lbs. per sq. in.

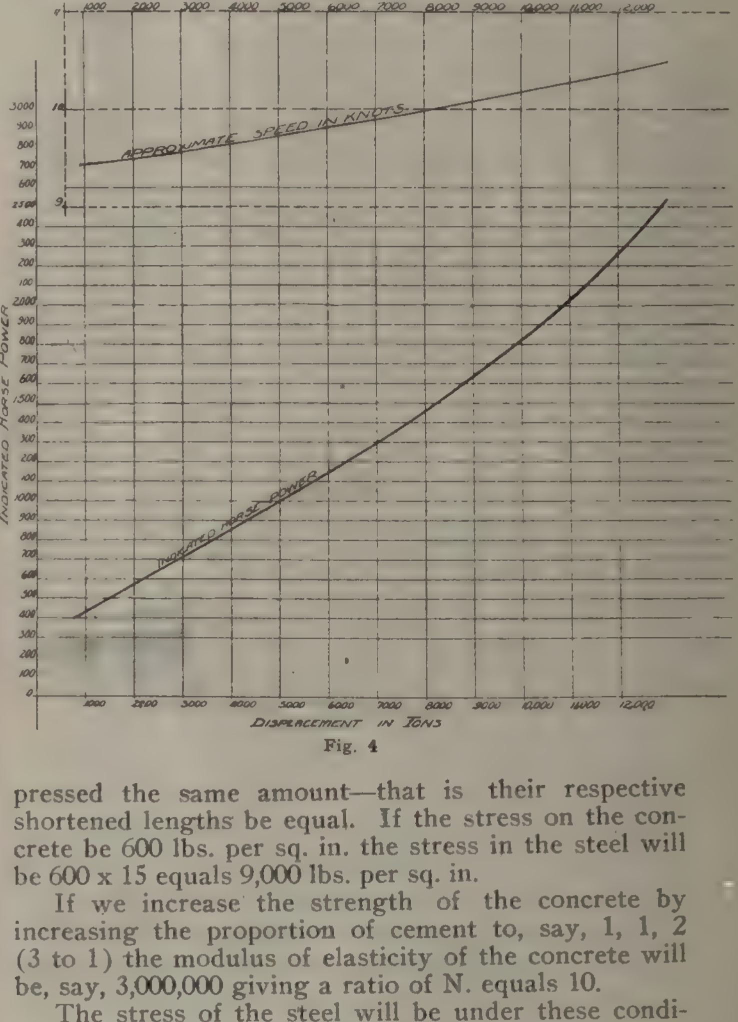


Fig. 4

If we increase the strength of the concrete by increasing the proportion of cement to, say, 1, 1, 2 (3 to 1) the modulus of elasticity of the concrete will be, say, 3,000,000 giving a ratio of N. equals 10.

The stress of the steel will be under these conditions 600 x 10 equals 6,000 lbs.

This brings us to the fallacy that with certain proportions of steel and concrete, in a compression member, if you increase the strength of the concrete you theoretically decrease the strength of the member, which is absurd.

The materials have been considered apart. which is the basis of all the formulae existing in by-laws and text books in America to-day.

There are many other points in these by-laws which are equally absurd. They have the effect of forcing the designer to adopt huge cumbersome dimensions for his work. There is absollutely no encouragement given for the use of high quality concrete.

Now, these are very important matters because they have effect on the engineer whose knowledge of reinforced concrete construction is limited to the clauses and restrictions in these by-laws.

Let us consider shear in reinforced concrete members, using the methods ordinarily employed in reinforced concrete design according to the various by-laws and text books. A slab thickness of at least fifteen inches would be required instead of the four inches that is used for the sides and bottom of 3,500 ton reinforced concrete cargo vessels. The fifteen inches enforced by the by-laws would not necessarily increase the factor of safety and if such by-laws applied to ships the construction of them would be entirely impractical, if not impossible.

A comparison between the working stresses adopted by Mr. R. J. Wig, Chief Engineer for the Emergency Fleet Corporation, U. S. A., for reinforced concrete ships, and the standard specifications of the Ontario Railway and Municipal Board for reinforced concrete, are as follows:

	Mr. Wig's unit stresses lbs. sq. in.	Ontario Ry. B'd.'s unit stresses lbs. sq. in.
(1) Maximum unit compressive stress in extreme fibre in flexure	1,500	650
(2) Maximum unit compressive stresses in extreme fibre in flexure adjacent to support of a continuous or fix ended beam..	1,700	650
(3) Maximum unit compressive stress in stanchions	1,000	550
(4) Maximum unit shearing stress in beams and slabs..	500	120
(5) Bond stress	160	60

We have to reallize what is involved in the structures Mr. Wig has charge of. The expenditure required for these ships alone is $55,000,000. In addition there will be the value of the ships' cargoes, and the risk of human life incurred. This will surely compare favorably with any structure on land which may be affected by the rulings of the Ontario Railway Board specifications.

The specifications are no exception to those generally found in municipalities and local governments throughout the Continent of North America. By-laws and regulations have remained for years without any alteration to permit the scientific application of our advanced knowledge of reinforced concrete. There is no reason why a building should not be constructed of the same concrete as used in ship construction other than the definite obstruction caused by such by-laws and regulations above referred to.

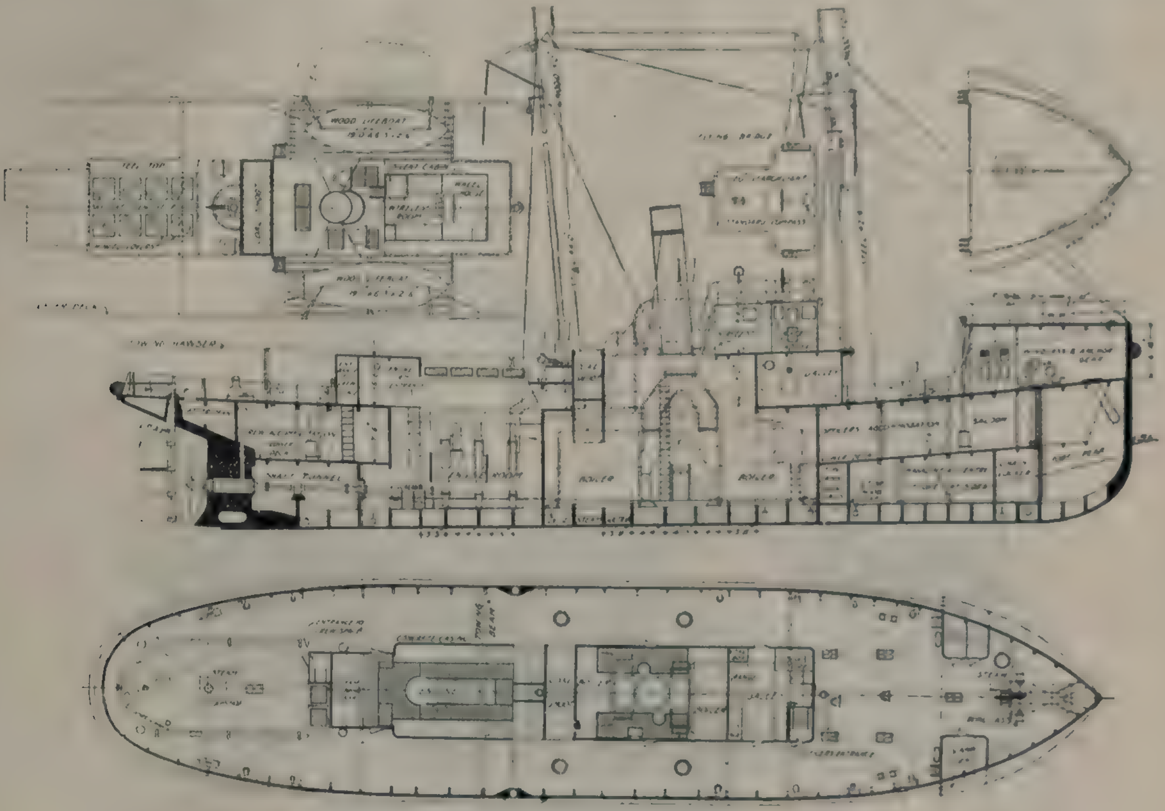
Mr. Wig's experiments have proven that there is a factor of safety of nine in the methods of calculation and recommendations of the Report of the Joint Committee of the American Society of Civil Engineers, which is generally accepted in Canada.

Mr. Wig's investigations to establish the safe working stresses and standards of design for the Engineering Department of the United States Emergency Fleet Corporation are most interesting and very valuable.

Tests that are of particular interest were made on beams 4 ft. 4 in. deep and 18 ft. 6 in. long, one beam 10 ft. deep and 22 ft. long, and specimen ship frames of full sized cross section and 20 ft. span. A device was made to mechanically apply load to the beams alternately upward and downward at the rate of about 36 load applications (18 complete cycles) per minute.

726,000 applications of the load had been made up to August 18, 1918. There was no perceptible increase in the strain in the steel or the concrete after the first 1,000 applications of the load, and very little increase between the first and the thousandth applications, notwithstanding the stress developed in the steel was about 23,000 lbs. per square inch.

All analytical investigations so far made demonstrate that a reinforced concrete ship can be design-



DETAILS OF 750-HORSE-POWER STEAM TUGS

Fig. 5—Designed by L. G. Mouchel & Partners, for the Controller General of Merchant Shipbuilding, England. Several of these tugs are under construction.

ed so as to carry all strains which may come upon a ship just as safely as steel ships.

All available experience with concrete ships to the present time does not demonstrate any structural weakness which might indicate unsoundness in the theory of design of reinforced concrete ships or probable limited life.

The principal advantages of reinforced concrete ship construction are briefly outlined as follows:

(1) Very rapid construction is possible.

(2) The initial cost of the hull is very low.

(3) Resistance to vibration in reinforced concrete construction is very high compared to steel.

(4) Reinforced concrete has an extremely high power of fire resistance.

(5) The durability of reinforced concrete is far superior to that of any other construction.

Fig. 6—1000 Dead weight ton Seagoing Barge designed by L. G. Mouchel & Partners, for the Controller General of Merchant Shipbuilding in England; length, 180 ft.; breadth, 31 ft. 6 in.; depth, 19 ft.; draught, 15 ft. Several of these Barges are under construction.

(6) The cost of maintenance of reinforced concrete is very small.

(7) The high monolithic strength of reinforced concrete compares most favorably with that of any other form of construction.

Steel or timber construction is essentially the building up of separate individual pieces of material and joining them together to form the construction as a whole. The joining of steel and timber is expensive and difficult to accomplish. It leads to great weakness, and it is a most difficult matter to make the joints capable of properly withstanding reversal of stress. The joining of members in reinforced concrete is effected by the lapping of steel rods in the concrete, the concrete itself serving to transmit the stress from one rod to another by virtue of its adhesion. Due to the lapping of the steel, an increase of strength takes place at the junction of members in reinforced concrete. Due to the monolithic strength of the material, the junction of members, as well as the members themselves, will stand considerable reversal of stress.

(8) In reinforced concrete vessels the damage will be localized in case of collision with sunken or floating objects, or in case of explosion. Consider a steel plate in the hull of a steel boat at the moment of penetration by a rock. The steel plate splits, but the material still retains its tensile strength, which is transmitted from one plate to another by the rivetting.

It is possible, and it has often occurred in practice, that the plate has been "crowded" or held on the rock and many plates torn from the ship's hull. Such a condition is impossible in reinforced concrete construction. Although the resistance to penetration can be made the same as steel, or greater, when once the reinforced concrete is penetrated the concrete is destroyed. The particles of sand, stone and cement disintegrate and posses no tensile strength, as in the case of the steel plate. The small diameter rods used for reinforcement cannot affect the structure in this way. The damage from explosion or collision, etc., will therefore be localized far more in reinforced concrete construction than in any other form of construction.

(9) Local damage to reinforced concrete work can be repaired very easily and cheaply. In many cases this repair work could be carried out without dry-docking the ship.

One of the greatest difficulties which we have to contend against in designing reinforced concrete ships is to reduce the tare weight of the reinforced concrete hull. Considerable advancement has been made in the deevlopment of a light-weight aggregate of "bloated clay." This aggregate has been discovered and developed by the engineers of the Emergency Fleet Corporation, U.S.A.

Concrete made of it weighs less than 110 lbs. per cubic foot, which is 20 per cent. less than that obtained from normal sand and gravel aggregates. It develops of strength in excess of 4,000 lbs. per sq. in. in 28 days.

By using this concrete the co-efficient of efficiency (a deadweight divided by a total displacement) has developed to about 60 per cent., which is a greater efficiency than wood ships and only slightly less than steel ships.

It must always be borne in mind that although the reinforced concrete ship will be of greater displacement to give the same weight carrying capacity, there will be a corresponding increased internal cubic capacity which can be used in an efficient manner commercially. A ship's cargo need not necessarily be of very high specific gravity, and it is definitely established that a reinforced concrete ship can be used more economically than a steel ship where a cargo of low specific gravity is carried.

I give herewith a series of curves showing relation of reinforced concrete ships to steel ships but no account is taken of light weight concrete, or other improvements which have been recently effected.

Fig. No. 2 shows the factors which the deadweight tonnage is multiplied by to give the displacement of the vessel.

From these two curves I have plotted the percentage increase in displacement of the reinforced concrete ship over that of a steel ship, shown in Fig. 3.

Fig. No. 4 shows the indicated horsepower required for a given speed and a given displacement of any ship.

Referring to Fig. 3 again, I have plotted the increased indicated horse power necessary for the increased displacement of a reinforced concrete ship giving the same deadweight carrying capacity as a steel ship.

It is interesting to notice that the increased displacement of a reinforced concrete ship of 7,500 deadweight tons is only just over 11 per cent., and the increased engine power required would be less than 14 per cent.

It remains to be proved that the frictional resistance of a polished concrete surface will be less than a steel ship, taking into consideration the uneven surface caused by lapping of the plates, etc. It is highly probable, however, that this frictional resistance will be less on a well-finished ship, and will reduce the percentage of excess power required for reinforced concrete ships, as the frictional resistance upon which these curves are based is that of a steel ship.

The fact that vibration is practically eliminated in a reinforced concrete ship should also add to the efficiency of the power equipment.

In the near future great improvements will undoubtedly be effected in the construction of reinforced concrete ships, which will increase their efficiency and cheapen their construction to a very great extent.

A patent has been recently applied for by Messrs. L. G. Mouchel & Partners, of London, England, which provides for the concreting of the bottom of the vessel before the reinforcement for the remainder of the hull is assembled. It also provides for the longitudinal bracing of the frames without the ordinary keelsons. Special provision is made for the interlocking and anchorage of the reinforcing bars in the bottom and adjoining parts, so that the continuity and monolithic character of the finished hull will not be affected.

The improvement will permit reinforced concrete ships to be constructed in stages similar to floors of a building. Special steel has been used in the construction of these ships. The rods are of ordinary low carbon steel. The cross section is that of a round bar with three flats, the circle being divided into six parts giving three circular portions and three flat portions alternating with one another. The bars are "physically developed" by cold twisting, so that a gain is made of about 40 per cent. in the ultimate strength, and of about 50 per cent. on the elastic limit. There are no sharp corners on these bars, so that the handling and bending is easy compared with square twisted bars. There is no distorting of fibres as in other deformed bars and the fibres are not over-strained to obtain maximum efficiency as the corner fibres in a square bar. The yield at the elastic limit without any increase of load that occurs in ordinary bars is eliminated

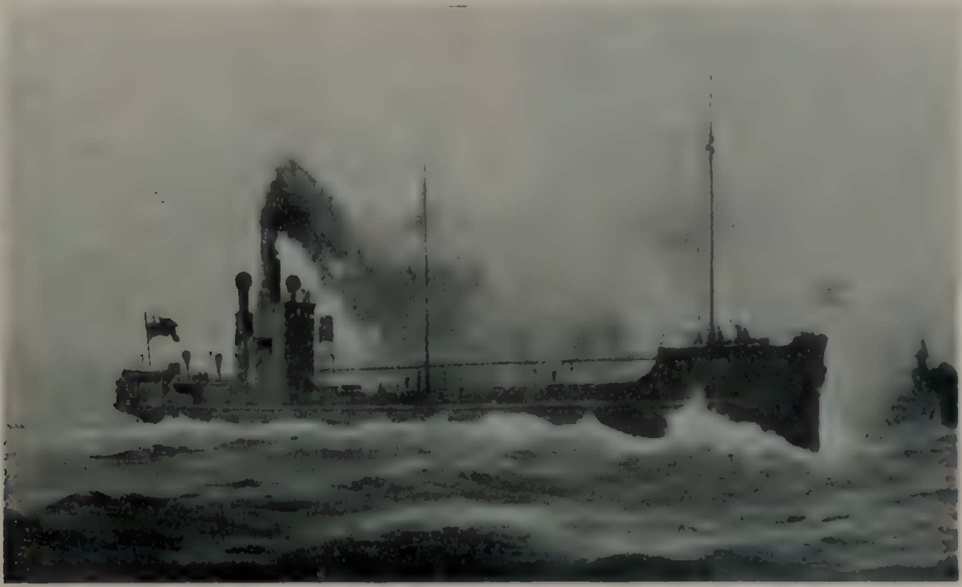


Fig. 7—1150 Dead weight ton Cargo Steamship designed by L. G. Mouchel & Partners; length 205 ft.; breadth, 32 ft.; depth, 19 ft. 6 in.; draught, 15 ft. 6 in. One of six similar Steamships which are being built in the yards of the Ferro-Concrete Ship Construction Co., at Barrow-in-Furness, England.

In the space of an article it is not possible to deal adequately on the subject of reinforced concrete applied to shipbuilding, but only to briefly sketch the situation. There is no question but that reinforced concrete shipbuilding is now an established industry, and has before it a great future. The production quoted (600,000 dead weight tons) is 20 per cent. in excess of the entire pre-war shipbuilding in the United States. The improvements effected, just touched upon above, will be innumerable in the very near future, and there will be very much cheaper production. There is much cost that can be saved in form work and in the labor of placing the steel and also in the quantity of the steel used. In time the merit of reinforced concrete will establish itself and no one can stop it. The ships that are built and being built will give proof in practical form, which will appeal to the most prejudiced mind, of the efficiency of good reinforced concrete work. It will light the way for reformation of the iniquitous by-laws and restrictions placed in the way of development of reinforced concrete construction, and show those who are responsible for these conditions that the way to guard public safety is not to restrict reinforced concrete engineers to low stresses and impractical and false theories, but to control and establish the efficient erection of the actual work.

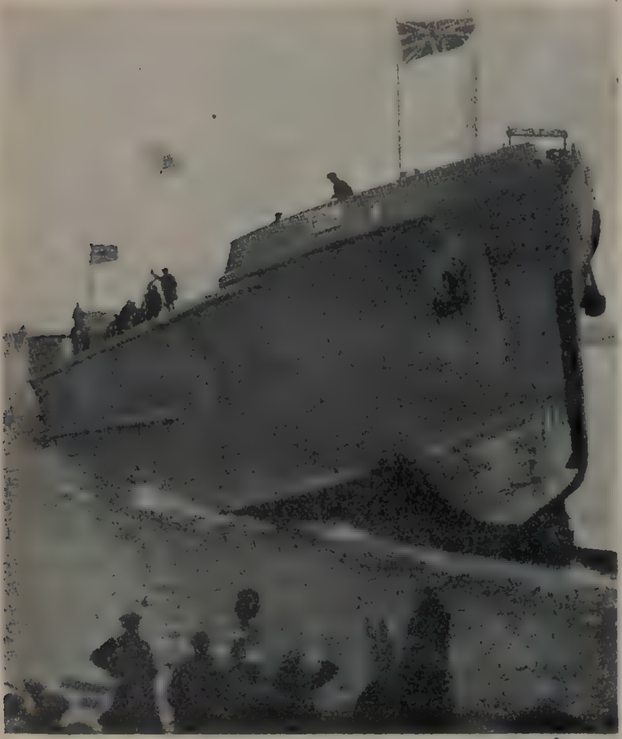


Fig. 8—Launching 1,000-ton Barge, shown in Fig. 6

Canadian Northern's Tunnel at Montreal

THE Montreal tunnel, from an economic point of view, was the subject of a most interesting illustrated address, given by Mr. H. K. Wicksteed, before a meeting of the Engineering Institute of Canada, Toronto Branch. The actual construction features were not detailed and will possibly be the subject of a further address.

The tunnel was opened for traffic on October 21, but this epoch in the Canadian Northern Railway's history was overshadowed by the news from the battle front and at the time caused little comment. The one tunnel in Canada that exceeds in size the new C. N. R. tunnel is the C.P.R. tunnel through the Selkirks. The C.P.R. tunnel was only a detail in the general improvement scheme while the Montreal tunnel was the missing link in the Canadian Northern's transcontinental line.

Montreal is wedged between the St. Lawrence River and Mount Royal, and its expansion has of necessity been along the river front. Montreal's increase in population has been phenomenal and it has been said that the city was choking to death for lack of room. The congestion in the city is quite apparent to even the casual visitor and the relief offered by the opening up of the territory beyond the mountain which has hitherto been inaccesible, will be welcomed.

To enable theC.N.R. to reach the heart of the city from the west it was necessary to go around the mountain or go through it. To follow the line used by the Grand Trunk or Canadian Pacific was out of the question. Twenty-five years makes a big difference in the growth of a large city and in land values. The public had found that level crossing of streets interfered with traffic and was dangerous. In view of these conditions, it was decided to tunnel the mountain.

The tunnel is double- tracked throughout and is three and one-quarter miles long, and the grade is just sufficient to provide good drainage.

Where the line runs through the city an absolute avoidance of grade crossings is secured and only a slight change of grade in one street was necessary.

With the exception of about 2,000 ft. the excavation was through rock. This section was through a deposit known as "Leda" clay, which is plastic and carries much moisture. A shield was used in boring this section and a double arch built of pre-cast blocks, resting on either side on the limestone walls and in the centre on a reinforced concrete wall. When the work was completed there was no leakage and very little settlement. Some old brick sewers had to be rebuilt, but the amount of damage was very limited.

A thin lining of concrete was found necessary as the roof proved to be somewhat seamy and friable, and some small falls took place. This concrete was placed by compressed air as the clearance and thickness of the arch ring was small. Mr. H. K. Wicksteed was chief locating engineer and the managing engineer was Mr. S. P. Brown. Mr. W.A. Lancaster designed the electrical plant and Mr. Fisher was in charge of levels and alignment. The final closure was out less than one inch and the levels less than one-quarter of an inch.

York County Road Improvement

The council of York county, Ont., at a recent meeting decided to set aside $100,000 as the county's share of the expenditure on road work. This, with an equal contribution from the city of Toronto, and $133,000 from the provincial government, would make a total of $333,000. Instead of the usual procedure of issuing debentures, it is proposed to raise the money as the work progresses. County Engineer James presented the report of the Toronto and York Highway Commission regarding the work carried out last season. With the exception of the lake shore, culverts have been provided on all roads. Improvements have been made on the Kennedy, Vaughan, Weston and Don Mills roads, but the work on the Kingston road is held up on account of the railway's refusal to ship stone to Port Union. A dangerous curve near Thistletown has been eliminated, also one on the Pine Orchard road, and thirty new direction signs have been erected in the county.

The Niagara Falls Branch of the Canadian Manufacturers' Association have recommended to the city council that it employ a competent city planning engineer to make a survey of the city and report on his findings and present to the city a comprehensive plan for development and beautification.

Factory Stairs and Stairways

By G. L. H. Arnold

IN solving the stairway problem, consideration must be given to: (1) number; (2) location; (3) size; (4) type; (5) materials; (6) safety treads; (7) proportions; (8) landings; (9) handrails; (10) enclosures; (11) lighting; (12) wear.

Number

Where building codes are in force, the minimum number of stairways permitted is usually ample. Perhaps the most usual code requirements are one stairway plus one for each 5,000 sq. ft. of lot area. In cases where the code provision is insufficient, and where there is no code, it is essential to consider: (a) safety; (b) capacity; (c) convenience.

Safety: No building over two stories in height is safe with less than two stairways. Large floors require an increased number of stairs even if but few people occupy the floor.

Two 4-ft. stairways for buildings having up to 20,000 sq. ft. of floor area, with one additional 4-ft. stair for each additional 10,000 sq. ft., is the least number that it is prudent to use.

If the building is liable to be used for purposes which may permit the occupants to be closely spaced, the number should be increased to two for the first 12,000 sq. ft. plus one for each additional 6,000 sq. ft.

At least one and preferably all of the stairways should be carried to the roof.

Capacity: In densely populated buildings the number of stairways must be increased to prevent dangerous over-crowding when all the occupants try to leave at once. In such cases, 20 in. in width for each 100 persons, the Boston rule for theatre exits, is high, and 10 to 14 in. would be ample.

Convenience. No question of convenience should be permitted to cause stairs to be so located that any occupant of a factory would be obliged to travel over 100 ft. to reach an exit.

Location

Every stairway should communicate directly with an exit from the building. The stairs should be distributed with a fair degree of uniformity and so placed as to reduce as much as possible the maximum distance to be traversed to reach an exit. On each floor the landing should be so placed that lines of men going from shop to locker room, locker room to stairs, and shop to stairs, should not conflict.

It is also highly desirable to avoid obstructing the foreman's view of the room. When practicable, the separate tower or wing is the most satisfactory location. The locker and toilet rooms and the elevator can be in the tower, thus leaving the main building clear of obstructions and giving the foreman an unobstructed view of the room and permitting greater freedom in the floor layout.

Size

A clear width of 44 in. to 48 in. between handrails will allow the passage of two lines of people at once and the main stairs should never be less than this. If wider, the width should be in multiples of 22 in. to 24 in., the number of handrails being such that it is never less than 44 in. nor more than 48 in. between rails.

Where the number of employees is large, it is better to increase the number of 4-ft. stairs than to increase the width. Even when the number of employees in a building is large, only one floor, as a general thing, will be densely populated. This crowded floor is as likely to be at the top as at the bottom. Therefore, it is the usual practice to make factory stairways of constant width throughout their entire length.

Occasionally a factory building must be designed to accommodate dense population on two or more floors. In this case the employees from the upper floors coming down at the full capacity of the stairways will find the lower flights already taxed to the utmost and serious congestion will result. The remedy is increased widths for the lower flights.

Additional stairways from the lower crowded floors may be steep, or ,if not much used, they may have of an emergency, when free and quick egress is most important, the occupants of the lower floors are likely to rush to the busiest stairway and leave their own special exit unused.

Special stairs, not used for general ingress and egress, may be as narrow as 20 in. in clear width; they may be steep, or, if not much used, they may have winders or be spiral.

Type

Except for special cases used by but few people for intra-department shortcuts, spiral stairs and winders should never be permitted in a factory. Straight runs alone are permissable. When the story height exceeds 9 ft., the flights should be cut and intermediate landings used. The landings should be rectangular and the flights should be not less than three risers nor more than 9 ft. high.

The intermediate landing is of little use if the flights are in line. A turn at the landing serves to limit a fall. A 180 degree turn has the further advantage of reducing the floor space required. In fact, the stairway of minimum floor area (barring spirals) has a landing and a 180 degree turn every 4 ft. in its height.

Materials

The factory stairs are usually of wood, cast iron, steel or steel with wood tread, steel with cast-iron tread, steel with stone tread, steel with concrete tread, or reinforced concrete.

The wooden stair in multi-story factories is not good practice. It is combustible and unsanitary. In buildings of mill construction, however, especially the smaller ones when not over four stories in height, sprinkled wood may be acceptable. The wood must be smooth, closely jointed, free from beads, and not less than 2 in. thick, making a slow-burning construction. It is imperative that the wooden stairs be enclosed in a fireproof well.

The saving in cost, however, over a non-combustible stairway is not great enough to warrant the risk except in special cases. Cast iron and steel, while non-combustible, are not fireproof. Nevertheless, they are permissable when, as it always should be, the stairway is in a fire-proof enclosure, since any fire hot

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[*] Paper presented at the New York meeting of American Society of Mechanical Engineers.

enough to weaken the metals would render the stairway impassable.

Steel channels are more reliable for stringers and, except for short flights, cheaper than cast iron, and are more generally used. Risers are usually of angle and steel plate or pressed steel. Theads, while usually of cast iron, are frequently of checkered steel plate, wood, slate or concrete.

Cast iron and steel plate, wear slippery and hence they are dangerous and should never be used without some sort of safety tread.

Wood, because of its inflammability, should not be used, except as a safety tread over a solid sub-tread. Slate does not wear slippery, but it is more expensive. It must be backed up by steel plate and replacements are expensive.

Concrete as a tread on steel stairs has no special advantage. The steel plate under tread is needed as it is for wood or slate, and to facilitate casting the steel is usually carried up to form a nosing. This is dangerous. The concrete is liable to crack off or wear below the top of the steel, leaving a lip over which, sooner or later, some one will trip and fall.

Reinforced concrete makes perhaps the most satisfactory stair if properly designed and built. There should be a good fillet between tread and riser for sanitary reasons, at least. There should be a nosing, which is not difficult to cast if made with a large fillet.

Safety Treads

Steel, cast iron, and concrete wear slippery and so become dangerous. Consequently, some form of safety tread must be used. Safety treads are made of: (a) lead; (b) abrasive material; (c) combination of the two; (d) cork; (e) wood.

Lead Safety Tread: The lead safety tread is made by inserting plugs of lead in pockets in a steel frame, the whole being fastened to the tread proper by screws. This of course wears more rapidly than cast iron or steel, but does not become slippery, and has no affinity for ice or snow. It is easily replaced when worn. The chief objections to it are that, owing to the grooves between the lead plugs, it is difficult to keep clean, and there is a chance for a heel to catch in the grooves.

Abrasive Safety Tread The abrasive tread is made of alundum or carborundum cast into hard metal, leaving the grit projecting slightly above the surface of the metal. The abrasive is also imbedded in the rounded nosing to prevent slipping on the edge of the step.

This type of safety tread is made to be used as the complete tread as well as the renewable safety tread bolted to a sub-tread. It is also made as a nosing, this form being especially useful on concrete stairs.

This is probably the most durable tread in heavy traffic. It is(however, hard and noisy and, like the lead tread, it is difficult to keep entirely clean. There is also a chance that the grit may be too sharp: Instances are known where the shoe has been gripped so firmly as to cause a fall.

Combined Lead and Abrasive Safety Tread: A third type of safety tread is made of grains of abrasive in a lead matrix, the whole carried on a steel plate. It is made either grooved or flat, and with the anti-slip surface carried to the front edge.

The flat top is a great advantage as it makes it possible to keep the stairs clean. For outdoor use, it shares with the lead tread the advantage that snow or ice do not adhere. It also shares with the other type of abrasive tread the danger of too acute a grip.

With either of the above three types of tread, it is not necessary to cover the entire width of the tread. If the front edge of the step to a depth of 3 in. to 3½ in. is protected by a non-slipping surface, the remainder of the tread only needs to be brought up flush with the safety strip.

Cork Tread: Cork as a safety tread is not so well known nor so widely used as it deserves to be. It is impervious to almost all liquids and hence is easily kept in a really sanitary condition. It is noiseless, wears surprisingly well and is the pleasantest of all materials on which to walk.

Unfortunately, its lack of strength makes it necessary to use a metal or wood nosing. This is not dangerous, however, because owing to the elasticity of the cork, the nosing will wear ahead of it.

When stairs are liable to rough usage, as by dragging heavy pieces up or down, the cork tile is sometimes used with a nosing having a lead or abrasive non-slip surface.

For use as a safety tread, the cork is compressed into tiles ½ in. thick by 9 to 12 in. sq. These are cemented to the sub-tread.

Wood Safety Tread: Except under the heaviest traffic, wood makes a splendid safety tread. Laid directly on top of a solid steel or concrete base and exposed only on the top and front edge, the fire risk is practically eliminated.

Wood offers one of the most satisfactory surfaces to step on. It is never slippery and it is cheap. The worst objection to it is from a sanitary viewpoint because it absorbs expectoration.

The wood should be either oak, maple or edge-grain yellow pine to wear well, the last-named being undoubtedly the longest-lived. Each tread should be made in three pieces. The rear strip will never need to be renewed and the centre strip but rarely.

Proportions

Although the pitch of stairs must be kept within comparatively narrow limits for best results, still it is possible to make a safe and reasonably comfortable stair at almost any pitch if due regard is paid to relation of rise to length of run.

The natural length of steps decreases rapidly as the grade increases, even on a ramp where the surface offers equal foothold at all points.

Failure to take this fact into consideration results in a stair which is awkward and tiresome, with a pronounced tendency to produce stumbling and falls.

The length of the foot, or rather of the shoe, is not an important factor. For one thing, the actual length of the tread exceeds the run by the amount of the nosing. For another, practically all the work of ascending and descending stairs is done by the ball of the foot. In ascending the weight is borne on the ball of the foot in the middle of the step while the heel projects in the air. In descending, the toe projects, the weight being borne on the ball on, or just back from, the edge of the step, the heel barely touching the step.

For adults, making the length of the run plus twice the rise equal to 24 in. to 24½ in. can be relied upon to give satisfactory proportions.

By this rule, the rungs of a ladder should have a 12-in. spacing, which is the recognized standard, and a 45 degree stair would have an 8-in. rise and an 8-in. run, which a wide experience shows to be entirely satisfactory. A horizontal grating would have a 24-in.

spacing, which, although a trifle short, is nevertheless within the bounds of practicability.

In factory practice, the tendency is to make the stairs steep in order to save room. Observation by several people over a period of years and under a wide variety of circumstances confirms the opinion that an 8-in. rise by an 8-in. run is the steepest stair practicable for general use and that 7½-in. rise by 9-in. run is much better. Some building codes prescribe 7½ in. as the maximum height or run. Although 7-in. rise by 10-in. run makes probably the easiest of all stairs the improvements over 7½ in. by 9 in. is not wholly worth the extra floor space consumed.

Out-of-doors stairs or steps should be made with only 6-in. rise, if possible. In any case, the rise and run must be uniform throughout the entire length of the stairway. Otherwise, falls will be frequent.

Landings

All landings should be rectangular and at least as deep as the stairs are wide. The surface should be of the same material as the stair treads. Attempts to save room by cutting off corners or reducing the size of landings, or by the introduction of winders or straight steps invariably result in accidents, especially when the stairs are crowded and every one is in a hurry.

Handrails

Each line of people on the stairway should have a continuous, firmly supported handrail at a convenient height and of such size and shape as to be readily and securely grasped.

The material may be of wood or metal. If of metal, the rail will usually be iron or occasionally brass pipe and of 1½-in. or 1¼-in. iron pipe size. The 1¼-in., although somewhat small, has the advantage that the fittings are more generally carried in stock. Large sizes are used but they are objectionable as they cannot be grasped securely in the frantic effort to recover from a misstep, especially by a person with small hands.

T-bars and special rolled, drawn or cast handrail sections, are frequently used but, except for the architectural effect, they have no advantage over the cheap and homely wrought-iron pipe.

If the rail is of wood, it should be of oak, ash or some other non-splitting hardwood; never yellow pine. It may be a round bar not less than 1¾ in. in diameter nor more than 2¼ in., or it may be one of the stock patterns carried by the mills.

In any case it must be strongly supported at a height of 31 to 33 in. above the front edge of the step. Around the landing, the height should be 36 in.

Open stairs require either a second rail at half height or a strong wire netting between stair and rail.

Enclosures

Notwithstanding the fire risk, the danger from things dropped or thrown, the chance for falls and the increased difficulty of heating, open stairways are frequently found in factories.

Every stairway should be enclosed in a fireproof well. In many cities a wire grill is permitted between stairs and elevators in the same well. A solid partition is more satisfactory and pays for the extra room and expense.

Choice of material will be governed by the same considerations as in the case of the other partitions.

The space under the bottom flight must be left open and kept clean unless filled up solid with non-combustible material.

If the stairs extend to the roof, the enclosure should be carried above the roof in the form of a bulkhead or pent-house high enough to allow a door 6 ft. 6 in. to 7 ft. in height.

If the roof flight is a ladder or a very steep stair, the pent-house may be replaced by a scuttle, or better, by a companion.

The door or scuttle should be hooked, latched, or bolted in such a way that, at any time, it can be opened readily from the inside.

The roof of the stair well should be a skylight with a wire netting under the glass to catch pieces of glass in case of breakage.

At each story liberal wire-glass windows with metal frames should be provided so that the whole shaft shall be as light as may be in daylight. The better the illumination is, the fewer days in a year will artificial light be required.

All stairway openings should be closed with Underwriter automatic fire doors opening with the outgoing current. The outside doors need not be fire doors but should open out. Where there is much traffic, the fire doors may be supplemented by glazed double-acting doors.

The locks on all these doors should be such that under no circumstances can a person be locked in.

Care should be exercised to locate these doors so that they may be opened without risk of crowding some one off the landing and so that a stream of people descending cannot prevent them from being opened.

Lighting

In the artificial illumination of the shaft, brilliancy is not required but thorough distribution is. A light should be placed at each floor and each turn. The lighting should be in duplicate.

Since there is always a likelihood of a small group of employees being in the place at night after the stair lights are out, it is quite necessary to reduce to a minimum the distance one must grope in the dark. For this reason the electirc lights should have double-acting switches at each end of each circuit and the emergency lights, whether gas, candle or lantern, should be so placed that each flight can be lighted on the spot.

Wear

Mr. F. A. Waldron, during the years 1896 to 1906, at the Yale & Towne Manufacturing Co., made extensive experiments on the wear of wooden treads constructed in three pieces. Hard maple, on account of its superiority for flooring, was taken as a basis of comparison. Mr. Waldron's method was to use the hard maple on every other step, putting the wood on trial on the alternate steps. Ordinary yellow pine proved to be very short-lived. Edge-grain yellow pine, on the other hand, proved to be by far the most durable, outwearing the maple two to one.

Where safety treads 3 in. or 3½ in. wide are used, practically all the wear will come on the safety tread and only this will need renewal.

The Railway Board has approved three by-laws submitted by the council of York Township, Ont., authorizing that body to raise $75,515 for waterworks construction purposes, in township districts "A" and "B".

The Growing Use of Pulverized Coal

By J. Cunliffe*

It has remained for twentieth century science to solve to some small extent the problem of waste in our crude methods of burning coal. To illustrate how serious this waste is, let us take for example the case of steam generation and its application to-day. A single pound of good bituminous coal contains about 14,000 b.t.u. of heat, and each unit is capable of conversion into 778 ft.-lbs. of mechanical work, so that the heat units in 1 lb. of coal, if it were possible to convert them completely into mechanical work, would equal 5½ hp.-hr., and 1000 hp. could be generated for 10 hours on less than 1 ton of coal. In practice, the best modern steam engines use from 8 to 10 tons of coal to maintain 1000 hp. continuously for 10 hours, and the average small plant requires 20 to 30 tons or more.

The use of pulverized coal has been demonstrated beyond doubt to give better results than any other fuel for many manufacturing purposes. It is more economical than oil fuel, producer gas, or coal burned in the ordinary manner for many purposes; its milling, distribution and burning can be done at a low cost, it is simple to use, and does not call for laborious work or any particular skill in operation. Furthermore, if properly applied a great economy in fuel can be effected. Pulverized coal, properly prepared and burned, promises a satisfactory remedy for the smoke nuisance, and when its merits are better understood by the public and its use becomes more widely extended, bids fair to make the cities of the future smokeless.

To John V. Culliney, superintendent of the American Iron & Steel Co., is due the credit of being the originator of the first really successful system of burning pulverized coal as a fuel for metallurgical purposes. He perfected a fuel-controlling device that turned failure into success, and form a small beginning over a decade ago the use of this fuel has extended to large proportions at the present time. This company alone is now operating 77 furnaces with this fuel, is doing the work of puddling, bushelling, rod heating, upsetting, etc., and consumes in its operations over 150 tons of coal per day.

Preparation, Application and Burning.

Speaking generally, if a good supply of bituminous coal is available at reasonable cost, and the fuel consumption will warrant the installation of a coal handling, milling, distributing and burning equipment, the use of pulverized coal will effect a large saving. To obtain the best results, powered coal must be dry and fine; and by "dry" is meant that it must not contain more than 1 per cent. moisture. This has a double advantage: dry coal requires less power to pulverize, and better results are obtained in burning it.

By "fine" is meant that 93 to 95 per cent. should pass through a 100-mesh seive, or 80 to 85 per cent. through a 200-mesh. In this state the particles are so finely divided that in a properly constructed burning apparatus each one is surrounded by the amount of air necessary for perfect combustion, and the entire fuel energy of the coal is liberated instantly. It is obvious that the finer the coal is the faster it will burn, since coal in a finely divided state exposes a much greater surface to the action of the flame and air than lump coal. The volatile gases of the pulverized coal ignite instantly upon the entry of the fuel into the combustion chamber; the fixed carbon in suspension is consumed by the heat of the volatiles, and to the casual observer the flame resembles that of oil or gas. By the addition of more air or fuel the flame can be varied at the will of the operator, the control simply consisting of opening or closing the valves that regulate the supplies. The fire is under absolute control at all times and the entire combustible content of the coal is converted into heat.

Coal Handling Equipment.

The following is a general description of the plant necessary for the preparation and burning of powdered coal: From the source of supply the coal is delivered to a crusher and reduced to a suitable size for delivery to a pulverizer. In passing from the crusher to the puverizer it is subjected to magnetic separation, to insure the removal of any tramp iron or steel it may contain. After passing from the separator it is raised to a storage bin, from which it is fed to the dryer and thence to a dryer coal bin. From here it is led to the pulverizer. The finished article is elevated to a suitable bin or receptacle, from which it is distributed by a conveyor to individual hoppers at each furnace and thence fed to the burners. The complete operation is nearly automatic and under absolute control all the time.

Feed Control

The controller or device which regulates the feed to the burners is to the powdered coal furnace what the carburetor is to a gasoline engine. It must be flexible in adjustment, and since it determines the amount of fuel supplied to each burner, it is attached to the bottom of the coal hopper at each furnace. It consists of two screws, the upper one propelling the coal forward to a certain point, at which it falls in a steady stream before an opening through which issues a jet of low pressure air, and by which it is carried to the burner. If the quantity delivered by the upper screw is greater than the air supply can carry, the excess falls into a cavity beneath, in which another screw of a greater pitch works in an opposite direction. The overflow is thus returned to the hopper.

The construction of the whole apparatus makes it impossible to jam. It is practically foolproof, and permits any portion of the falling stream of coal up to the capacity of the screw being used at the will of the operator simply by turning on more or less air.

The quantity of air passing the controller is about one-seventh the amount required for complete combustion. The balance is of much lower pressure, and enters the furnace at the burners. The controller screws are operated by chain drive, or connected direct to variable speed motors as conditions may require.

The current of controller air serves a double purpose. It not only forces the coal to the burner, but in picking it up gets intimately commingled with it, and both enter the furnace in a well-mixed cloud. This cloud is ignited immediately upon its entry into the combustion chamber, and meeting there the balance of air necessary for complete combustion bursts into a clean flame. The length of the flame can be changed by simply adjusting the burner to suit any desired purpose. The volatile content of the coal has also a material effect on the length and nature of the flame, but proper adjustment may be made therefor immediately. The use of this new fuel has been so simplified that operators soon become accustomed to it, and have no difficulty in regulating the furnaces to meet any necessary requirements.

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*From a paper before the Vancouver Chamber of Mines

For small furnaces, where a more or less uniform class of work is done, such as rod-heating, heating small forgings, in nut and spike furnaces, etc., the controller is so speeded as to give the maximum amount of fuel required for each heat, and is so arranged that the operator cannot exceed this amount. In large furnaces such as open-hearth, continuous billet, re-heating, etc., a variable change-speed device is employed, and is usually capable of a wide range of operations. There are some cases where it is desirable or even necessary to maintain a constant degree of heat in the furnace, and variation would interfere with results. In others, such as puddling furnaces, etc., it is necessary to push the furnace at one period and slack off or hold the heat uniform at another. All these conditions can be satisfactorily accomplished in the control of a pulverized coal fire.

Objections to Storage or Pulverized Coal

The objections put forward against the storage of pulverzied coal over long periods are that coal in a finely divided state, even when enclosed in air-tight receptacles, loses much of its occluded gases, and a considerable part of its value as a fuel. Further difficulty may be experienced from caking due to excessive weight in the bins, and the material may not run freely.

Moreover, the preparation and burning of coal in the powdered form is not confined to the dry method alone. A machine for doing this kind of work is known as the Aero pulverizer, manufactured by The Aero Pulverizer Co., New York, N.Y., because an exhaust fan causes an induced current of air to circulate through the pulverizing machine. The coal is fed to the machine, powdered and delivered to the furnace without artificial drying. This machine was first designed to meet the needs of a long flaming cheap fuel for cement making, and has been applied later to various other industries. In construction it differs from the dry pulverizer, inasmuch as neither outside drying, milling, nor storage is necessary, and the finished product is diverted direct to the furnace as made. The machine is compact, and reduces to a minimum the floor space for installation. It is offered in stock sizes with capacities varying from 600 to 5,000 lbs. of pulverized coal per hour, and is so compact that it may be installed on a locomotive tender, or adjacent to each furnace on steamships, and the fuel fed to the furnace as it is pulverized.

The smallest size occupies a space 5 ft. long, 2 ft. 6 ins. wide, and 2 ft. 6 ins. high, and has a capacity of 600 lbs. of pulverized coal per hour. The large size occupies a space 10 ft. long, 4 ft. wide by 5 ft. high, and has a capacity of 5,000 lbs. per hour. The machine may be set up either at the front of a furnace, on either side or above, and attended with little labor by the ordinary fireman. Neither dryers, elevators, nor storage bins are necessary; the mechanism is dust-tight and self-contained, has few parts to get out of repair; the principal wearing parts are easily accessible and may be quickly replaced from stock duplicates by any ordinary mechanic.

For manufacturing purposes in the East the use of pulverized coal has made remarkable strides in the last few years. Firms using it report that it is more efficient and economical than any other fuel, and agree that when it is better known it will have a wide industrial application. It has the added advantage of removing to a great extent the present smoke nuisance in domestic heating. Coal could be pulverized at some suitable point and distributed in a manner similar to that employed with the fuel oil now used. The furnace changes necessary would be small and cost little, and the expense principally confined to the purchase and installation of a small compressor plant to furnish an air supply.

Toronto's Sewage Disposal is Big Problem

THE problem of Toronto sewage disposal was dealt with in a joint report of the Medical Officer of Health and the Commissioner of Works, presented to the Toronto Board of Control. The possibility of pumping the sewage to a point several miles outside the city limits appears to be out of the question at the present time. It is pointed out in the report that, in normal times, such a project would cost $10,000,000 for the installation of the necessary plant and equipment and the annual operating cost would amount to $250,000. Attention is called to the fact that even if the sewage could be pumped outside the city limits, it must still be treated. The question of discharging the sludge, from which the odor is said to arise, to a point beyond the limits of the city, would reduce the capital expenditure and is being investigated. A summary of the report is that the art of sewage disposal is not upon such an assured basis that the results would justify the recommendation of such an enormous expenditure. Any solution must be adequate, and until it has been demonstrated beyond peradventure that the system recommended will accomplish results, such a huge outlay is not justified.

The general annual assembly of the Royal Architectural Institute of Canada will be held on Friday, Jan. 17, at the Arts Club, Montreal, and on the following day the members of the Institute will attend the annual meeting of the Province of Quebec Association of Architects at their rooms, on Beaver Hall Square, Montreal.

According to the New York Times there is an impression among steel men that fixed prices will be discontinued on Jan. 1, when the period for which the quotations were established comes to an end. Cancellations of war orders proceed, but there appear to be encouraging signs of an increase in commercial orders, many of which may be for export. The situation, steel-makers say, will be governed by the extent of commercial buying which develops in the interval.

While there are no very large contracts being carried out in Regina at the present time, it is stated that never before was the volume of fall building in the city so satisfactory.

The Immediate Future of Building in Canada

Expressions of Opinion From Well Know Authorities East and West

NO one can say definitely what the immediate future of building will be in Canada, but we can well follow the lead of men whose lifelong experience have been among building and construction interests. During the past few days, we have received some valuable expressions of opinion from well-known sources both east and west, and while they all agree on the wisdom of going soberly and laying a good solid foundation for peace prosperity, there is no whisper of "pessimism." The following are typical:

Winnipeg, December 2, 1918.

Editor, Contract Record:

Replying to yours of November 27, with reference to our views as to the outlook of the building trade in Western Canada, will endeavor to give you our opinion briefly.

(1) It is our opinion that the building business will be given quite a boost in the Spring, on account of the ending of the war, as restrictions will be removed on the importation of several classes of materials which have held up certain classes of building in the last two or three years. Labor should be more plentiful, and while I do not feel that labor will be any cheaper as measured by dollars and cents, the increased efficiency of labor by the men being more content, and staying with the job longer perhaps, will reduce the cost of the different undertakings materially.

(2) There is no doubt but that there is a great need of residences and apartment blocks in Winnipeg, and most every other Western city, and there should be quite a few residences especially, erected during the next year.

(3) I am not a believer in the Government doing any kind of work that is unnecessary, chiefly to make work, but I do feel that there are numerous undertakings which the Government laid aside when war broke out, that could be proceeded with, and would relieve the labor situation.

(4) There should be millions of dollars spent in the three Western provinces in improving the public highways, and building public highway bridges. If the Provincial Governments would do this, it would aid the Dominion Government in their land settlement scheme for soldiers. There are millions of acres of particularly good land lying adjacent to the City of Winnipeg, where soldiers would go and settle, if they had public highway facilities, but I do not believe that they will ever get soldiers to go into a far remote place and live alone, when there is so much vacant land so near to the large cities, where they could have all the modern conveniences if the land was only properly drained, and public highways built and maintained.

(5) I do not believe that the returned soldiers will make an over-plus in the labor market. There is so much room for them in this country, and so much to do, and in view of the fact that it will possibly take the Government a year or more to demobilize the Canadian forces, that they will be assimilated into the present population without any notice of over-crowding in any particular line.

(6) Prices of building materials will no doubt take a long steady decline down to a certain point. I do not believe that building materials will ever reach the previous low prices of 1912 and 1913, but as the different factories get reorganized and there is a demand for their output, and as their help settles down and works steadily, they should be able to materially reduce the price on their products, and still make a fair profit, which I believe they will do.

(7) I feel that the future holds a wonderful opportunity in the building and material supply business. There is no end to the construction work that has to be done. All our railroad lines require immediate extensive repairs and there will be, I feel, in the next two years more work in this Western country than we will be able to secure men and material to do.

Carter-Halls-Aldinger Co., Ltd.,
(Signed), W. H. Carter.

Winnipeg, Man., November 30, 1918.

Editor, Contract Record:

In response to yours of the 27th inst., I beg to hand you the following remarks in connection with the building situation for the coming few years.

With the close of the war and the assurance of an enduring peace in sight in the immediate future, individuals and corporations will be directing their energies towards the problems of construction and development works. These works having been to a large extent in abeyance during the past four years of war activities will again be resumed with the increased vigor and revived stimulus. In no other line of development work will this be more noticeable or more energetically pursued than in the construction of roads.

During the past four years no great effort was made by the municipalities of this province to build extensive systems of improved roads; although during that time several municipalities continued programmes of construction which had been begun before the outbreak of war. But in general the position taken by the municipal authorities during the war was merely to do such road work as was necessary to carry on the business of the country without serious interruption and the least possible outlay for new development work. Old bridges had to be renewed and in many cases these were constructed of permanent material, such as concrete or steel.

Now that the abnormal restrictions on capital expenditures are raised, the prospects for the undertaking of public works, such as road building, are encouraging. The necessity for more and better roads in the province is urgent and proper facilities for marketing the produce of the country is an essential feature of the whole agricultural industry, and the people of the country realizing this, will now demand their construction and maintenance.

With the return of the soldiers, the scarcity of labor which has been so acute during the past two or three years, will, to some extent, be relieved, although with the numbers that will be drawn into the renewed building and other industries which have been more or less dormant during the war, and also with the very large percentage of these men that will be attracted by the land occupation and other settlement plans of the

Government, it cannot be reasonably expected that the labor market will be gutted by them.

Any great reduction in the existing prices of building materials cannot be expected in the next year. Anything near pre-war prices can only come when the reduced supply can again be brought into its proper relation with the demand. The reclamation and reconstruction of the devastated war areas will continue for some years to draw upon this supply, so that some time must surely elapse before the proper relation between the supply of these materials and demand for ordinary extension and improvement works will be restored.

Under "The Good Roads Act, 1914," of the province, which provided for Government assistance and co-operation with the municipalities in the construction of roads, several money by-laws will be submitted at the forthcoming Municipal elections; others will be submitted later in winter, so as to be in readiness for next year's construction season. It is expected that by-laws for schemes of road improvements, aggregating an expenditure of $1,300,000.00 will be passed by municipalities this winter. This, along with works already arranged for, will make an estimated expenditure at present in sight for this class of work of $1,600,000.00.

These works will of necessity extend over several season's operations and will be continually added to by other districts of the province, thus making a very busy outlook for the future in this class of work.

(Signed), A. McGillivray,
Highway Commissioner.

Montreal, December 4, 1918.

Editor, Contract Record:

During the last four years we have heard and read about the wonderful achievements of Canada during the war, in supplying men, munitions and food, and, undoubtedly, we have a right to be justly proud of our ability to accomplish same, but have we ever stopped to consider what this accomplishment has meant to Canada in an industrial sense, during these past four years and more of strife?

Just think of Canada, with a reputation of being mainly an agricultural country, not only upholding this reputation and feeding many millions of people outside her own borders, but, at the same time, becoming a large producer, manufacturer and exporter of lines which may be classed as "industrial." War material, you will say: Granted, but still she supplied it, and if she was able to keep the wheels of industry going at such a great rate to supply war needs, why can she not keep them equally busy to supply the requirements of peace times?

Despite the croaking pessimists, these requirements are going to be very heavy, not only at home, where there will undoubtedly be a great demand, but also abroad. We had already been exporters in pre-war days, and the past four years have developed us and caused us to become widely known in this regard. Now that we have opened up the market abroad and advertised ourselves, are we going to throw this all away and drop back to our pre-war ways? Surely not. We must not lose such an opportunity of maintaining this export trade. Remember, the exigencies of war compelled us to ascertain what we should have known before—that we have the materials and facilities right at our own door, and all that is necessary is to develop them. All the factories and shops which have sprung up during the war cannot and must not now be scrapped. It would be economically criminal to even think so. Of course if we are going to listen to those people who will tell us all that happened after previous wars, and of the hard times that ensued after peace was declared, then we can easily drop back into the old rut. But "Let the dead past bury its dead;" we live for today, and for the future. What happened fifty or sixty or a hundred years ago has nothing whatever to do with what is happening now. If we are all going to think and expect hard times, then we will surely get them, but if we make up our minds that there is no necessity for hard times, and that we can take advantage of our own resources, and share in the reconstruction and expansion of post war days, then we can all prosper.

Is Canada, or are Canadians going to lie down and let the other fellow make away with the cream of this prosperity? Well, surely we have shown a better spirit than this, and our motto should be "Keep busy." We have the resources in material, money and labor. All we need is the will to do it.

Speaking of labor; what do we propose to do in this connection? The stoppage of war orders, of course, has caused a closing down of many plants or portions of them, with the resultant release of many workers. Is it the intention of this country to lose the benefit of such an army of workers, whose war training has developed them into another class, that of skilled labor. Do we realize what an asset we have right here, when we are thinking of supplying the wants of those foreign countries, which are only too eager to absorb all we can furnish. Furthermore, what are we doing towards preparing opportunities and openings for the war-scarred heroes who will soon be returning, eager to get back and take up once more their proper place in their own country; and remember they look to this country to find them openings and opportunities. And why should they not? We have not only demonstrated our abilities in production, but we have demonstrated our financial strength. Therefore, having the money, the resources, material and labor, let us show that there is no room here for pessimism, and that we are practical optimists.

We made a name for ourselves during the war. We can retain this name, and build up this Canada of ours to attain the heights and hold the high place which Destiny has marked out for her.

Yours truly,
(Signed) J. M. Ward.
Mussens Limited.

Toronto, Dec. 4, 1918

Editor Contract Record:

Of course, I don't think that my judgment in matters such as this is any better than your own, for the reason that it is simply a matter of opinion. However, may say that I feel very strongly that the Federal and Provincial Governments, as well as all municipalities throughout Canada will, of necessity, have to attack the problem of public works in a larger way for the next three or four years, if for no other reason than to give ordinary commercial business enterprises an opportunity to re-establish themselves according to after-war conditions.

I have, personally, come in contact with conditions recently that warrant one in believing that there is going to be a great break up in ordinary lines of business as applied to labor. As an illustration, I know of one case where about 1,000 men were released inside of a week or so just recently, and before the week was out they had evidently found employment elsewhere for the reason that there was no trace of them to be had and upon enquiry it was discovered that many of them had been given employment in Northern Ontario regions in mines, lumbering, etc. It must be remembered that, as applied to the lumber industry, very little of our Northern Ontario timber has been cut during the past two years on account of the scarcity of labor, and I understand that at the present time many of the larger firms are now getting together gangs to go into the bush for the winter.

Furthermore, we all know that mining companies have been short of labor during the past two years, and they will no doubt absorb a lot of surplus labor, and if we are fortunate enough in the ordinary lines of industry in Canada, to have them take up the surplus thrown on the labor market as a result of cessation of munition manufacturing, we will all be glad, as it will relieve the problem of the returned soldier; it should be kept in mind that the returned soldiers will come back to Canada in more or less small detachments as compared with the way they went over, and this fact should make their problem the easier to handle.

Personally, I feel that it is absolutely essential that public works of every manner and description be undertaken just as soon as financial conditions will permit, as this will provide work for many, because it has to be looked upon not only from a viewpoint of material to be supplied, but also as a means of supplying employment for many, that is, strictly applied to labor conditions.

Furthermore, it should be borne in mind that public works, by which I mean federal, provincial and municipal, have been more or less starved for four years, and, to say the least, there is a great deal to be done in this country, and I feel certain that the public men of the country will see the situation from the same viewpoint as you and I and will render all the assistance they can to restore normal conditions.

I understand that it has been officially announced that work will be proceeded with on the Welland Canal, which will provide employment for many, and, as regards Toronto Harbor improvements. I have every reason to believe work will be commenced thereon in a fairly large way in the spring of 1919.

Someone once said that an optimist is one who sees a light where one does not exist, and a pessimist is one who is continually trying to blow the light out, and so far as I am concerned you can classify me among the former at all times, for I sincerely feel that if the situation is looked upon from a pessimistic viewpoint and elaborated by editorials and news items it will not be long before everyone assumes a more or less pessimistic attitude, and this would be one of the worst things that could hapen in Canada.

We are a young country with enormous natural resources for development, and have the opportunity of doing many things for the benefit of development of Canada as a whole, and if the public in general can only be made to see that it is necessary to get behind the load and work hard there will be no difficulty whatever in getting through the period of re-adjustment quite successfully.

We have had many enquiries from American industries contemplating locating in Canada, but the majority of them seem to be holding back awaiting the protocol of peace, and while they do not say so outwardly, it is evident they have in mind the fact that there will be some British Empire and allied preferential tariffs.

My own personal judgment regarding tariffs (and I am free to confess that I am not well versed in such matters) is that if the British Empire provide the preferential tariff as between the Mother Country and the Colonies, this will do more to force American industries to establish themselves in Canada, than anything else could do. They are fully aware that the British Empire market is large, and to gain the advantage of such preferential tariffs as may be made operative, they will, of necessity, have to establish branch plants in Canada.

I sincerely hope and at the same time feel that the next ten years will probably be the brightest period in the history of Canada from an industrial and commercial viewpoint.

Yours very truly,
(Signed) E. L. Cousins,
Chief Engineer and Manager,
Toronto Harbor Commission.

Mainly Constructional

East and West—From Coast to Coast

A revision of the building by-laws of the city of Toronto has been completed by the city architect, Mr. Pearse

Quebec City proposes to borrow $274,000 for new paving and waterworks extensions.

Arrangements have been made for the supplying of water to the Homeside district by the city of Hamilton.

It is proposed to start work on new civic offices in Winnipeg next spring.

Mayor Davidson, of Winnipeg, states that the city will go immediately into a housing scheme.

Bush Mines, Limited, has been incorporated with a capital of $1,000,000, head office at Vancouver, B.C.

The Gold Creek Mining & Development Co., Ltd., has been incoporated with a capital of $1,000,000, head office at Britannia Beach, B.C.

It is reported that estimates now in preparation at Ottawa will provide for an early commencement of work on the long-delayed central post-office in London, Ont.

A steel bridge is being erected over St. Peter's Canal in Nova Scotia, under the supervision of Mr. E. P. Murphy, C.E., to replace a wooden structure.

The Producer Co., Limited, has been incorporated with a capital of $75,000, head office at Jedway, B.C., for the purpose of developing quartz-mines situate on Moresby Island, of the Queen Charlotte group.

The Frontenac County Council will memorialize the Ontario Government to make the highway from Kingston through Joyceville and on to the easterly limits of Pittsburg township, a provincial county road.

The Waterworks Commission of Brantford, Ont., is considering the complete reorganization of their waterworks system. This will probably involve the installation of filters for the purification of the river water.

The Tidewater Copper Company, whose head office is at Seattle, Washington, has been registered as an Extra-Provincial company in the Province of British Columbia, with local headquarters at Victoria.

The Ottawa board of control will take up with the government and with the railway the question of having the G.T.R. cross-town tracks removed in order to avoid the construction of a number of subways and viaducts.

A company recently incorporated under the firm name of Ecclestone, Limited, with a capital of $10,000, head office at Vancouver, is authorized to carry on, among other operations, a contracting business.

Work is beginning on an eight-mile extension of the Alberta and Great Waterways Railway from the present end of steel at Mile 274 to the Clearwater River. It is expected work will be completed before the end of the year.

Union terminals of the Canadian Northern and the Grand Trunk Pacific railways are to be located in Moose Jaw, Sask. Plans call for a depot to be situated on Stadacona Street East, between Third and Fourth Avenues North-East.

The city council of Brantford, Ont., at a recent meeting declared itself opposed to the contract system for the construction of public works in the city and refused to ratify a contract with D. O. Johnson for the construction of a storm sewer on Morrell St., at a cost of $22,000.

The McKenzie Machinery Company, Limited, has been incorporated with a capital stock of $200,000, head office at Preston, Ont. Among other operations, this firm is authorized to carry on the business of general contractors for the construction and equipment of public and private works, and of engineers.

Marriott rural municipality, No. 317, near Rosetown, has won the Saskatchewan provincial road drag contest and a prize of $250; Moose Mountain R. M., No. 63, is second, and wins $150; Wallace R. M., No. 243, wins the third prize of $100.

The last girder has been completed on the great railway bridge across the Peace River. Construction began in January, 1917. This structure was described in the Contract Record of January 2, 1918. The grade is ready for 70 miles beyond the bridge and rails will be laid sixty miles further.

November's building permits in the city of London number 42 and are valued at $110,690, as against 68, valued at $85,010, for the corresponding month last year. The total for the eleven months of this year is 775 at a value of $848,680, as compared with 817, valued at $803,300 for the same period last year.

All tenders for the construction of the extension to the Bridge street sewer have been rejected as too high by the Vancouver and District Joint Sewerage Board, and it has been decided to carry out the work by day labor. The estimate of the board's consulting engineer, Mr. A. D. Crerar, is $68,300.

The building permits issued in Welland, Ont., for the month of November are valued at $9,300, as compared with $14,150 for the same month in 1917. The total for the first eleven months of this year is $427,304, as against $240,334 for the corresponding period of last year.

The suggestion is made in London, Ont., that the federal square and city hall scheme, which had been interrupted by the war, be embodied in a plan to commemorate the part London men have played in the war. The original scheme entailed an expenditure of over a million, but it is now proposed that this be elaborated upon and an adequate memorial erected in the form of a civic edifice.

City Engineer Brazier, of London, Ont., has prepared a traffic census to support the claim of East London for the elimination of grade crossings. It is shown in Mr. Brazier's report that Egerton street, which is one of the principal streets, is blocked, on an average, for eight hours in each twenty-four, being crossed by more than twenty tracks. In one day nearly 400 trains passed at this crossing, almost every one interfering with traffic.

The expenditures on the roads of Elgin County, Ont., up to the middle of November totalled $70,968. This will be increased by the cost of work in progress, the completion of contracts and grants to villages. The construction work has included five concrete bridges, eleven culverts and the grading of approximately fifty-one miles of road. The machinery purchased included 6 road graders, 53 road drags, 6 road scrapers, 3 wheel scrapers, 2 road plows.

On Dec. 3, the Canadian Pioneer, the first of the steel freighters built under the Dominion government's shipbuilding programme, was launched at Montreal. This is the second largest bulk cargo steamer in the world, having a tonnage capacity of 8,100, with dimensions of 400 ft. in length, 52 ft. in breadth and 51 ft. in depth. Another vessel was launched the same day, both from the Vickers yard. Under the government's programme, altogether 37 vessels have been contracted for, including 14 of the 8,100-ton type, six of the 4,300-ton type, the two latter classes being lake boats.

Personals

Mr. A. Grant is being employed by the city commissioners of Montreal to inspect the walls of the city aqueduct.

Mr. G. L. Lambe has resigned as assistant city engineer of Port Arthur, Ont.

Mr. C. H. Tillett has been appointed acting signal engineer of the Grand Trunk Railway, in succession to Mr. B. Wheelwright, who is now engineer of maintenance of way of the Grand Trunk lines in New England, under the U. S. railroad administration.

Vancouver friends were recently notified that Lieut. William Frederick Gardiner, who, before enlisting, early in the war, was a well-known local architect, is now in No. 2 General Hospital, London, suffering from severe shrapnel wounds in the legs, received during the fight for St. Quentin.

Col. Geo. G. Nasmith, Ph.D., C.M.G., Director of the Bacteriological Department of the city of Toronto, met with an accident recently, by slipping on the steps of the city hall, which resulted in a broken leg and necessitated his being taken to hospital.

Wm. Fraser, architect, and Harold S. Kaplan, associate architect, of Toronto, Ont., have opened offices in the St. Paul Bldg., Barrington St., Halifax, N.S. They have been successful in winning the competition for two new school buildings for which they are now preparing working plans.

Mr. A. W. Campbell, who was for many years Deputy Minister of Public Works and Highways, and latterly Federal Deputy Minister of Railways & Canals, has been appointed by the Dominion Government as a commissioner to take up the matter of a Federal scheme of good roads' promotion. Mr. Campbell is a most enthusiastic booster for better highways, being familiarly known as "Good Roads" Campbell, and his appointment by the Government indicates that they propose to give definite and whole-hearted support to the movement.

Obituary

Hon. E. H. G. Hay, former Minister of Public Works and Labor for the province of Manitoba, passed away recently in his 77th year.

Herbert Geo. Lawley, engineer on the staff of the B. C. provincial water rights engineer at Nelson, died recently of pneumonia following an attack of Spanish influenza.

Mr. Leonard O. Clarke, of Toronto, died recently in his 38th year. Mr. Clarke was a prominent civil engineer and surveyor, his work being chiefly confined to the development of northern Ontario. It was he who surveyed the townsite of Cobalt. Of late years he had been engaged on contract work for the C. P. R. on the Lake Superior division.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Edmonton, Alta.
City Council contemplate construction of sewers to The Swift Canadian Co. Ltd. plant. Engineer, A. W. Haddow, Civic Blk.

Ottawa, Ont.
City Council contemplates construction of sewage system including pumping unit. Commr. of Works, A. F. Macallum.

Central Canada Exhibition Assoc., City Hall, contemplates drainage of Lansdowne Park. Secretary, J. K. Paisley.

Sarnia, Ont.
By-laws are to be submitted in January for construction of water mains from here to Pt. Edward costing $150,000 and local mains costing $15,000, sewers costing $9,000, 24 in. intake pipe costing $60,000, and paving on Milton, Campbell, Palmerston and Green Sts., for City Council. Engineer, Mr. Hall.

Smithville, Ont.
By-law is to be submitted in January for grading and paving costing $4,000 for Township Council. Clerk, F. W. Roberts.

Stratford, Ont.
Tenders are being received by clerk, Peter Smith, R. R. No. 1, St. Paul's Station, Ont., until January 13th, for construction of "Hepburn" tile drain.

Strathroy, Ont.
City Council contemplates laying sidewalks and pavement on Front St. Engineer, E. R. Smithrim.

Swan River, Man.
By-law is to be submitted on December 17th, for repairs to roads costing $108,000 for Rural Municipality. Clerk, Jos Armstrong, Box 153.

CONTRACTS AWARDED

Outremont, Que.
Water mains on Rockland and Ducharme Aves. for City Council: General contractor, Montreal Water & Power Co., 11 Place D'Armes, Montreal.

St. John, N. B.
Water main costing $16,000 for City Council: General contractor, Bedford Construction Co., East St. John.

Sarnia, Ont.
Tile sewers costing $10,848 for City Council: General contractor, Thos. Grace, 317 Wellington St. Prices wanted on tile.

Railroads, Bridges and Wharves

Back Bay, N. B.
Tenders are being received by R. C. Desrochers, secretary of Department of Public Works, Ottawa, until noon, December 31st, for renewal and repairs to Public Wharf.

Champlain, Que.
Department of Public Works, Ottawa, contemplates repairs to wharf.

Halifax, N. S.
Department of Public Works, Ottawa, contemplates harbor works at terminals.

Kelowna, B. C.
Superintendent T. C. McNabb, Revelstoke, is preparing plans for contemplated railway extension costing $25,000 for C. P. Rly.

Ottawa, Ont.
Plans are prepared and work will start in Spring for steel bridge for Department of Public Works, Ottawa.

Portage La Prairie, Man.
By-law is to be submitted on December 17th, for construction of three bridges for Rural Municipal Council. Clerk, D. McGowan.

Prince Rupert, B.C.
G.T.P. Rly., Main St., Vancouver, contemplates construction of dock. Engineer, A. L. Brownlie.

St. John, N.B.
Department of Public Works, Ottawa, contemplate harbor works at terminals.

St. Marys, Ont.
Work is to start shortly for cement bridge for G. T. Rly. Supt., C. Forrester, London.

Victoria, B.C.
City Council contemplates construction of bridge. Clerk, W. J. Dowler.

Wiarton, Ont.
Township Council contemplates erection of bridge over Indian River. Clerk, Geo. Atkey.

CONTRACTS AWARDED

New Westminster, B.C.
Repairs to jetty costing $1,000,000 for Department of Public Works, Ottawa: General contractor, Hodgson & King, 626 Pender St. W., Vancouver.

Public Buildings, Churches and Schools

Camp Borden, Ont.
Department of Public Works, Ottawa, contemplates taking over camp from Imperial Munitions Board, and will remodel and utilize as demobilization hospital and convalescent buildings.

Hamilton, Ont.
Plans are drawn for Sunday School for Presbyterian Mission, 465 Wentworth St. N. Architect, McPhie & Kelly, Bank of Hamilton Bldg.

Montreal, Que.
P. Butler, Cab Stand, Phillips Sq., is erecting a $25,000, one-storey, concrete and public garage, and will buy building material.

City Council contemplate construction of waiting rooms, conveniences and ticket office.

Ottawa, Ont.
Site has been purchased for maternity hospital costing $150,000 for Salvation Army, who also contemplate erection of addition to children's home. Chief Com., Mr. Richards, Slater St.

Dr. A. B. McCallum, Chairman of Council for Scientific & Industrial Research, has recommended the erection of laboratory building, near here. Estimated cost is $500,000 and equipment $100,000.

Public Works Dept. are preparing plans to alter barracks into hospitals and discharge buildings. This will affect buildings in all parts of country.

Priceville, Ont.
Plans are to be prepared for town hall which was destroyed by fire. Clerk, J. S. Black.

Renfrew, Ont.
Collegiate Institute Board contemplate erection of collegiate institute. Principal, Mr. Baker.

Saskatoon, Sask.
Collegiate Institute Bd., 11th & Victoria Sts., contemplates erection of $250,000 addition to school. Architect and Building Commr., R. B. Blackwood, Box 1508.

Sketch plans are in progress for church costing $10,000. Architect, Norman L. Thompson, 35 Willoughby Blk.

Toronto, Ont.
Board of Education contemplates erection of addition to high school. Sec.-treas., W. C. Wilkinson, 55 College St.

Victoria University contemplates erection of memorial chapel. Registrar, A. L. Langford.

Bathurst St. Methodist Church and roof of Sunday School damaged by storm. Loss, $3,500.

St. Aidan's Anglican Church contemplates erection of parish house. Rector, Rev. Dr. Cotton, 2132 Queen St. E.

County Council contemplate erection of children's home. Clerk, R. W. Phillips, 57 Adelaide E.

Board of Control contemplates erection of reception hospital costing about $50,000. Dr. Hastings, M. O. H. has condemned present building.

Verdun, Que.
Tenders will be called in about two weeks by architect, J. E. A. Benoit, 1200 Wellington St., for alterations and addition to commercial school for R. C. School Commissioners.

Weston, Ont.
By-law is to be submitted in January for erection of new school costing $60,-

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Canadian Good Roads Convention in Quebec Next May

THE next convention of the Canadian Good Roads Association will be held at the end of May next in Quebec City.

The directors of the Association held a meeting in Montreal on Nov. 29, when the question of building good highways, as part of the Government reconstruction programme, was discussed. The meeting was attended by the president, Mr. S. L. Squire; Capt. J. Duchastel de Montrouge, city manager of Outremont; Alderman W. Findlay, of Ottawa, president of the Eastern Ontario Good Roads Association; Mr. Andrew F. Macallum, city engineer of Ottawa, first vice-president of the association; Mr. B. Michaud, deputy minister of roads, Quebec; Mr. J. W. Levesque, M.L.A. for Laval; Dr. Desaulniers, M.L.A. for Chambly; Mr. A. I. Caron, president of the Automobile Club of Canada, and Mr. George A. McNamee, secretary-treasurer of the association.

The Association has offered its co-operation in connection with the reconstruction proposals of the Government, and the following resolution was adopted:

"The directors of the Canadian Good Roads' Association have observed with satisfaction the announcement that the building of modern highways will form an important part of the reconstruction programme of the Dominion Government, believing as they do that no other public works are more urgently required in connection with the improvement of conditions in agriculture, industry, and of the people generally, or will afford so much labor in proportion to the money cost.

"This association is aware that various provinces already have well organized highways departments, equipped as to personnel with men of engineering and executive ability and possessing a vast amount of information about the conditions and requirements in their respective provinces.

"Appreciating the efforts of the Dominion Government in reconstruction work, and the call which has gone from Ottawa for assistance in such work on the part of all bodies, government or otherwise, in the manner in which each is best fitted to assist, and realizing the advantages of avoiding duplication of effort, this board unanimously resolves, as follows:

To Divide Cost

"1—To communicate with the governments of the various provinces, respectfully suggesting that they offer to carry out such highway building plans as may be arranged on a basis as to cost between the Dominion and provincial governments to be agreed upon.

"2—To communicate with the Government of Canada, pointing out the facts cited above, and respectfully suggesting that the Government of Canada favorably consider the advisability of using the road-building knowledge and facilities of the provinces by making grants for highways which may be built by the provinces, in consideration of certain expenditures by the provinces themselves; and that the Government of Canada call into counsel representatives of the various provinces at the earliest possible date to give effect to so much of this resolution as may be agreeable to it."

It was reported that the membership, particularly Nova Scotia, has been considerably augmented.

A Good Canadian Motto

IT has always been difficult to understand why so much of our engineering, contracting and designing work goes to the United States. Surely it is time we in the British Empire came to the realization that it is typical of our own people to minimize their worth, just as it is truly typical of our neighbors to the south to magnify and advertise their ability, and this is no reflection whatever on the ability of United States engineers, contractors and architects. Their aggressiveness does them credit. But we must be constantly on our guard lest we judge home and foreign talent by what they say of themselves for, in that case, our home talent will surely suffer. We must judge by deeds—not by words.

At the recent convention of building and contracting interests in Ottawa this question was again discussed and the memorial presented to the Dominion government contained a request to the effect that "the construction of public works of any nature be entrusted to Canadian contractors and to them only." This should apply with equal strength, we believe, to provincial governments, municipalities and private corporations. Why not? Is there any proof that Canadians are less efficient? Is it not evidently in the best interests of the Dominion? Is it anything more than ordinary courtesy in business that any corporate body which lives by selling something to the Canadian people—services or goods—should reciprocate by purchasing from Canadians—services or goods—when they are themselves in the market to buy.

In this connection it is of interest to note that attitude in the Canadian Bank of Commerce, one of the largest and wealthiest financial institutions in Canada, and whose building operations consequently mount up to a very considerable sum each year. Mr. John Aird, the general manager, recently stated in a letter to the press that the motto of his bank is — Canadian architects, Canadian workmen, Canadian materials. Doubtless it was merely a slip of the tongue that he did not include "Canadian contractors." There are, of course, many, many Canadian firms like the Bank of Commerce, but the present moment is opportune, when building promises greater activity, for all Canadians to remember that distant fields look greener only because they are so far away and that just as Canadians have shown themselves during the past European struggle the equal of anything in the wide world, so in the buiding up and developing of their own country they may be depended upon to show the same excellent qualities.

Is Canada in the Race?

At a recent meeting of the Reconstruction and Development Committee of the Dominion Cabinet, Dr. Macallum, chairman of the Council for Scientific and Industrial Research, again spoke in favor of the establishment of a central institute for research. He pointed out that such an institute is vital to successful and permanent Canadian competition with the highly organized industries of the United States, Great Britain, France and other countries, and urged the immediate erection at some central point, preferably Ottawa, of a laboratory building costing approximately half a million dollars. This building, it was said, would provide accommodation for a sufficient number of laboratories to cover the immediate needs of all the essential industrial research subjects. Dr. Macallum proposes that this laboratory shall provide modern, scientific equipment and methods for investigating Canadian raw materials, industrial processes and manufactured products; serve as a national laboratory for standards of all sorts; for the testing of materials; discovery of methods of utilizing by-products of manufacture formerly wasted, and shall be available generally for experimental work to further the application of science to industry. It was pointed out that in Great Birtain the trade organizations, under the direction of the British Research Council, are reaping great benefit from the National Physical Laboratory, near London, and other institutions of a similar nature. In the United States the functions of a similiar laboratory are performed by the Bureau of Standards at Washington and the Mellon Institute at Pittsburgh.

Dr. Macallum's points are well taken. It must be evident to all that Canada may either depend on other countries for second-hand scientific industrial information, may establish her own laboratories and have first hand knowledge, or, as a final alternative, must withdraw from the race as a manufacturing and industrial country. No country has greater natural resources and advantages in the way of industrial development and yet we have done no real initiative work in this development. Canada has representatives in England at the present time, working in close co-operation with the Research Council there, and advice and co-operation should be of the greatest value if we are really prepared to make the effort to gain recognition in the markets of the world.

It is announced that McGill University is making preparations to include something of the science of aeronautics in the courses offered by its Faculty of Applied Science. The University of Toronto, in its Faculty of Applied Science and Engineering have also been preparing for a similar course for some months and already have the greater part of the equipment necessary for this course in place. Aeronautics will naturally be included in the Mechanical Engineering course.

The Summary report of the Mines branch of the Department of Mines for the Calendar year of 1917, has just recently been issued. It comprises some 150 pages and includes individual summary reports of the various divisions of the mines branch.

An Architect's Claim

IN the Montreal Court of Review judgment has been confirmed—with Justice Greenshields dissenting—in the case of R. E. Bostrom, architect, vs. Stanford's, Limited, under which payment by the company of a sum of $343 was held to be in full settlement of plaintiff's charges for preparing preliminary sketches with respect to certain changes and modifications that were proposed to be made in defendant's business premises. Plaintiff named $900 for his professional services in accordance with the tariff governing the Architects' Association of the Province, plus $43 which he disbursed for the benefit of defendants. He accordingly sued for a total amount of $943.

Defendants admitted the engagement of plaintiff, but added that on December 15, 1914, he rendered a bill fixing his charges at $243.

Plaintiff denied this, and alleged that in December, 1914, seeing that the work was not apparently to be done at once, but believing that when it was done his services would be continued as a supervising architect, he made an estimate of the actual cost in money of preparing the preliminary sketches and sent it as an interim account, in order that he might be reimbursed his out-of-pocket expenses in connection with the same pending his further employment by the defendant as its architect. He reiterated his right to the full amount of $943. The trial judge maintained defendant's offer of $243 and dismissed plaintiff's claim for the surplus.

It was this judgment that Justices Demers and Panneton confirmed in review on Saturday. Justice Demers said they were of opinion that plaintiff's account as rendered on December 15, 1914, was definite and final and not intermediary. The architects' tariff laid down the maximum charges. There was nothing to prevent an architect from making his estimate on a lower basis, and in many instances this was done in all justice.

Mr. Justice Greenshields, in dissenting, said that if plaintiff was to be deprived of an absolutely just claim the Court must find in the proof documentary and oral, a clear, unqualified intention on his part to make a generous donation of $700, without the slightest consideration, and when he was under no obligation to reduce his account by one cent. His Lordship could not find such an intention disclosed, either in the letter of December 15, 1914, or in plaintiff's statement. He found the contrary and would reverse the judgment and award plaintiff $943, with interest from the date of service and costs in both courts.

Unemployment Only for the Pessimists

REGARDING the immediate building and construction prospects in Canada we have just seen a list of projected works which totals approximately a quarter of a billion dollars. Some of these works may not go forward in the year 1919, it is true, but also it is quite likely that others not yet mentioned in public may materialize and maintain or even swell this total. For example, there is one large enterprise we know of involving several million dollars that has only been discussed so far behind closed doors. Also with numerous factories recently given over to munitions now freed for other work, we may expect the establishment of new industries and the extension of our trade to new lines never before attempted or thought of in Canada. At a certain point in Canada there is a large electric generating plant of some five or six thousand horsepower capacity, until recently used exclusively for war work, now lying idle. It is reasonable to suppose the owners of this plant—men of high financial standing—will bring in, or themselves establish, industries to absorb this power. And these are merely isolated cases of the possibilities—probabilities indeed—that a lot of building and construction work not yet talked of, must materialize within the next few months.

One gets a fair idea of the tremendous activities we may experience in the near future, if we stop to compare the building activity of (say) the year 1912 with the period since that time. In 1912 the building permits in 35 Canadian cities were $185,000,000; since that year they have averaged somewhere around $35,000,000 for the same cities. Now, on the supposition that the building in 1912 was normal, we have an annual delayed programme, not allowing for any growth above 1912, of $150,000,000 during the past six years—a total of $900,000,000. And this is for 35 cities only. Whichever way you figure there seems to be very little prospect of much joy in life for the pessimist.

Montreal Building Interests Reorganizing

FOLLOWING up the conference of the Canadian Building Industries in Ottawa, on November 26th-28th, the Montreal Builders Exchange proposes to widen the scope of its activities. The directors have called a special meeting of the members, at which the following suggestions will be recommended for acceptance. To commence with, the name would be changed to the Association of Canadian Building & Construction Industries (Montreal Branch). It is also suggested that with a view to stabilizing industry, the Montreal Builders' Exchange be reorganized as the first branch of the newly formed association of C. B. C. I. and that the basis of reorganization be the three sections which worked for efficiency at the Ottawa convention, viz.: (a) General contractors or contracting engineers, (b) separate or sub-trade contractors, (c) Supply houses or manufacturers and producers of building materials. It is also planned that later each section be divided into sub-sections as the necessity arises.

It is believed that this basis best suits the present condition of the building and construction business, and that it will permit of the independent working out of the peculiar interest of each section and still retain all the benefits of collective action where the aims are common.

The general contractor section would be broadened out to include all classes of work, such as building construction, public works, railroads, shipbuilding, bridges, dams, road work, sewers, etc.

The sub-contractors section is to include all individual trade contractors as well as organzied sub-sections such as mantle and tile dealers, sanitary and steam engineers.

The building supply section would include all manufacturers of building materials, as well as dealers and agents handling such materials from stock or on commission. This section also would be sub-divided, so that all members engaged in one specific line could form a separate sub-section for the consideration of their peculiar interests.

It is provided that the directors of the Montreal district shall be a president, a first, second and third vice-president, who shall respectively be chairmen of the three sections, and a representative of each regularly organized sub-section; no section to have more than five representatives on the board. Two other members of the board shall be an honorary secretary and hon. treasurer. Between the monthly meetings the affairs of the branch shall be conducted by the executive, composed of the three elective officers—president, hon. secretary and hon. treasurer, and the three vice-presidents.

The membership of the association shall include all present members of the Montreal Builders' Exchange and any other eligible candidates residing in Montreal district, which shall extend to and include all adjacent towns in Quebec and Ontario nearer by rail mileage to Montreal than to any other organized district building association branch of this Canadian organization.

Conditions for Housing Loans

THE general conditions have been announced by the Ontario Government under which money will be loaned by the local government to municipalities and housing companies for the erection of low-priced dwelling houses. The Province of Ontario, according to population, will receive an allotment of somewhere between seven and eight millions of the twenty-five million dollars set aside by the Dominion Government, and it is hoped that municipalities and others will proceed immediately to supply the existing demand for more housing accommodation.

Under the announced regulations, municipalities may borrow money to the full extent of the value of the houses and land and properly organized housing companies may borrow up to the limit of 85 per cent. of the combined value of the houses and land at a rate of 5 per cent. An individual holding a lot may borrow money to the full extent of the value of his house or, in case he does not own a lot, by making a cash payment of 10 per cent. of the combined value of house and lot he may borrow the balance at 5 per cent.

Loans may be obtained only on houses which do not exceed $2,500 in value and the house and lot together must not exceed $3,000. It is proposed that the occupants of these houses shall purchase them on a rental basis, covering not more than twenty years; that is, the monthly rental is figured out at such an amount that the total value of the house, plus 5 per cent. compound interest, will be paid at the end of twenty years, or any shorter period that may be decided upon. It is stated as an example that a $3,000 house and lot on this basis would become the property of the householder in twenty years on the payment of $20.00 a month rental for that period.

If one may criticize this scheme of the Government's, it is that the value of $2,500, placed as a maximum for a house and $500 for a lot, is not sufficient in the larger centres and under present building conditions to provide anything more than the crudest accommodation. There is a grave possiblity that the houses will be more or less of a shoddy nature rather than of the substantial, permanent type which would be possible with the expenditure of, say, another thousand or fifteen hundred dollars. It is quite probable that places like Toronto, Montreal and Winnipeg will be quite unable to make use of the offer at all because in these places a $2,500 house must necessarily be of the nature of a shack—not the type of building that any municipality would care to encourage within its limits. In towns and villages and on farms the scheme should prove very helpful. It would seem, however, that some consideration will have to be made in the case of cities where the cost of building is very much higher.

Manitoba Good Roads Contests

A MEETING of the Executive of the Manitoba Good Roads Commission was held recently in Winnipeg, at which reports by the judges of the good roads competitions were heard and approved. The prizes will be presented at the Road Convention of the Union of Municipalities, to be held in Winnipeg on January 21, 22 and 23. Prizes are offered yearly for the best stretch of split log drag road in both gravel and earth classes. In the gravel class the first prize is $5.00 and the Banfield cup; second prize, $30.00; third prize, $20.00. Two special prizes are also awarded, the first $20.00, donated by T. R. Deacon, and the second, a watch, by the T. Eaton Company. The fourth prize is $10.00. In the earth class the first prize is $50.00 and the Henry Birks and Sons shield; second prize, $30.00; third prize, $20.00; fourth prize, $10.00, and fifth prize a gold watch fob, presented by Henry Birks & Sons. The judges were S. R. Henderson, A. McGillivray, W. F. Tallman and A. C. Emmett. In their report they urged that municipalities be more careful in using the sign cards which indicate the pieces of road entered in the competition. These signs not only tell at once the exact piece of road to be judged, but also indicate to the travelling public the results of a well-dragged road.

The Executive discussed the recently announced policy of the Dominion Government to provide monies for the development of roads and road improvement, in all the provinces and sent a telegram to Ottawa urging that the spending of this money be handed over in each case to the provincial government.

An invitation was extended to Mr. A. W. Campbell, recently appointed commissioner by the Dominion Government to outline a federal good roads scheme, to attend the convention in Winnipeg, January 21-23.

Toronto Municipal Projects

There are a number of quite important municipal projects in Toronto which have been obstructed by the war. The following are among the big works which have appeared on the Works Department estimates since the war began and which have been struck off or held over:

High-pressure fire system extension to include district south of Albert St. and between Sherbourne and Spadina..	$600,000
Extension of water distribution system east of the Don and north of Gerrard street	375,000
South Glen Road Bridge	140,000
North Glen Road Bridge	310,000
Sherbourne Street Bridge	151,000
Spadina Road Bridge...	63,200
St. Clair Avenue Bridge (Moore Park)	335,000
	$1,983,570

It is reasonable to suppose that some of these at least will be undertaken in the near future.

Sir John Willison on Industrial Reconstruction

SIR JOHN WILLISON, chairman of the Toronto Industrial Reconstruction Association, recently gave an interesting and informative address regarding the problems of reconstruction, before the Canadian Credit Men's Association in the Board of Trade rooms, Toronto. Sir John pointed out the difficulties of the situation, but was optimistic as to their solution through "organization, co-operation and production." He said: "If the country can be carried through the next six months, it is my conviction that we will enter on a long period of prosperity. Precedents may have to be discarded for the moment. The time demands initiative courage and energy and the co-operation of all interests to insure satisfactory peace conditions."

Sir John declared that between 1,200,000 and 1,500,000 of the population of Canada would be vitally affected by the cessation of hostilities. It had been said that Canada would be able to absorb the returning soldiers, because the country had absorbed thousands of immigrants annually in previous years, but, in fact, the Dominion had never been able to absorb immigrants except in periods of prosperity. This was so much the national policy that in periods of depression, legislative measures were adopted to restrict immigration.

Regarding our national debt, Sir John pointed out that instead of $336,000,000, it has now reached a figure between $1,200,000,000 and $1,500,000,000. The greatest yearly revenue before the war was $173,000,000, whereas for the future there will have to be raised between $300,000,000 and $350,000,000. On the other side of the ledger, however, he pointed out that while in 1914 the total value of exports of Canadian manufactures was $57,000,000, there had been an increase of over 1,000 per cent. in this figure during the war.

"As organization, co-operation and production have proved important factors during the war, so they will maintain prosperity in Canada during the period of reconstruction, and carry the country steadily and triumphantly to greater achievements. It is vital that confidence shall prevail and that employers and employed co-operate, that between farmer and factory there be sympathy and understanding, and that from the Government at Ottawa there shall be decision, energy and action."

Continuing, Sir John emphasized the necessity of prompt action to relieve the labor situation and the housing situation. Necessary housing and necessary public works should be undertaken at once. "There should be immediate co-operation between governments and municipalities to determine what public works are necessary, and to proceed with these works as the needs of labor require. In determining what public works are necessary we should not think solely of employment. There is enough to be done in this country without going into unwise investments. There should be alike co-operation to relieve the scarcity of houses and to assure that housing accommodation will be adequate when the soldiers return."

He did not think that, even with the $25,000,000 appropriated by the Federal government and $2,000,000 appropriated by the Ontario government, there would be very much more money than was needed, but he hoped no municipality would be unwise enough to go into housing merely to take advantage of the cheap funds.

Sir John said there should be immediate steps taken to resume necessary public works, and such undertakings as would be permanent national investments.

While a great responsibility rested on the Government at Ottawa, he believed it would prove equal to it. If the exports of Canada can be maintained at between $400,000,000 and $500,000,000 a natural development can be established between the industries and agriculture. There have been satisfactory conditions in Canada during the war because the industries have been active and prosperous. If that had not been the condition there would have been industrial stagnation and unsatisfactory agricultural conditions.

In the speaker's opinion, taxation of capital was the worst form of taxation that could be devised in any country. "In proportion as you reduce the earning power of capital," he said, you check the spring of enterprise and reduce your activities, but if you give capital free play and take from the proceeds of capital a legitimate return in taxes you accomplish the same result, only in a much more satisfactory manner.

"The supreme thing for us is to so legislate and so develop our national policy that the raw materials of Canada will be carried to the last process in Canada, building up Canada instead of other countries, to which the raw materials of Canada will go if they are not manufactured here."

The certain result of the policy of preference to which the British Government was committed, Sir John declared, would be to bring many factories to Canada. The restoration of the devastated countries of Europe would also mean tremendous business for the Dominion.

Regarding the labor situation, he said that one of the great dangers in every country to-day was in the relation between capital and labor, but he had found the attitude of employers had been in recent months to meet labor more than half way. He believed that most good would result from labor and capital getting closer together in the spirit of co-operation, so that each would understand the other's difficulties.

Supplymen Present Report at Ottawa Convention

Owing to the lack of space in our issue of Dec. 4th, which contained an account of the proceedings at the Ottawa conference of Canadian Building Industries, the following report, which was submitted by the supply men's section and which was referred to the executive board for further consideration, was omitted. This report is of intertst as expressing the supply man's viewpoint of the best way in which to obtain that harmonius co-operation which is so desirable among the various elements of the building industry:

"The committee of the Supply Section, composed of Messrs. Baines, Cameron and Gibson, appointed by your committee, beg to submit herewith a resolution for the re-arrangement of trade relations existing between general or sub-contractors and suppliers of building materials.

"Whereas the builders supply companies are desirous of reducing the price of materials to the lowest point compatable with sound business policy, and since such reduction is contingent on an elimination to as great an extent as possible of financial risks and credits, and

"Whereas, the present amounts held back on contracts under present arrangements are not sufficiently large to liquidate debts for materials in the event of the insolvency of the sub or general contractor, and

"Whereas, the element of time existing between the letting of general or sub-contracts and material contracts is so great as to encourage the growing vicious practice of price peddling and price cutting, and

"Whereas, the builders supply concerns are keenly desirous of assisting in the larger programme now under consideration and believe this assistance can best be rendered by reduction of the large number of accounts receivable, it is necessary for them to carry, under the present system without suitable security, and

"Whereas, there is a belief that an impetus in building will undoubtedly call into existence a large number of contracting firms of such insufficient stability as will militate against our best relations with reputable contracting companies, and

"Whereas, the present condition of material credits, securities and bartering for low prices with insufficient profit protection is a factor of reaction against reputable contractors and in favor of unscrupulous practice—

"Therefore be it resolved:

"1. That where supply concerns are asked for prices on material by a sub-contractor or general contractor, and these prices are used in the making up of tenders, in the event such contractors are awarded the contract he or they shall immediately award the moterial contracts to those supply firms whose prices were used in making up such contract tenders.

"2. That copies of material tenders given to general contractors or sub-contractors shall be forwarded to the architect and general contractor to facilitate the awarding of material contracts at the time the general and sub-contracts are let.

"3. That supply men should insist on terms of 'Thirty days net' as a means of reducing risks and credits and as an indirect means of reducing prices of material.

"4. That either bonds or forms of security be placed by builders supply companies and sub-contractors with the architect or with each other and contracts shall not be considered finished and all parties released until obligations of payment for materials or services have been liquidated.

"5. That the builders supply section of the Canadian Building Industries does strongly suggest to its members that necessity of urging these resolutions."

The Governor-General has recently approved of the appointment of Mr. W. A. Bowden, chief engineer of the Department of Railways and Canals, to the Dominion Power Board. As the work of the Board will undoubtedly involve a study of problems affecting navigation and canals, Mr. Bowden's advice and assistance should be of great value to the Board.

The Eastern Ontario Good Roads Association has initiated a scheme for a metropolitan area of improved highways around Ottawa, connecting up with the provincial county roads which the association has been advocating.

Good Roads Interests Ask Assistance From Dominion Government

A widely representative delegation interviewed members of the Dominion Government recently to urge federal assistance for the construction of good roads. Assistance through the provinces was advocated in preference to the creation of a federal department of highways, in view of the necessity of early action, and the resolution passed by the directors of the Canadian Goods Roads Association was submitted, as follows:

1—To communicate with the Governments of the various Provinces respectfully suggesting that they offer to carry out such highway building plans as may be arranged on a basis as to cost between the Dominion and the Provinces to be agreed upon.

2.—To communicate with the Government of Canada pointing out the facts and respectfully suggesting that the Government of Canada favorably consider the advisability of using the road building knowledge and facilities of the provinces by making grants to highways built by the various provinces, in consideration of certain expenditures by the Provinces themselves, and that the Government of Canada call into council representatives of the various provinces to give effect to so much of this resolution as is agreeable to it.

While no specific recommendation was made as to the amount of Federal assistance, there was a suggestion of thirty per cent. by the Dominion, the remaining seventy to be borne by the Province.

Sir Thomas White, acting premier, in reply, did not make a definite promise, but was quite sympathetic to the requests of the deputation. The following were among the delegates: S. L. Squire, president of the Canadian Good Roads Association; L. B. Howland, president Canadian Automobile Association; Wm. Findlay, president Eastern Ontario Good Roads Association; Hon. Frank Carroll, president Quebec Automobile Club; J. F. M. Stewart, Toronto Board of Trade; F. Jarram, vice-president Ottawa Motor Club; C. J. Foy, Perth, vice-president Eastern Ontario Good Roads Association; F. Roden, president Ontario Motor League; Russell T. Kelley, and C. M. Doolittle, Hamilton Board of Trade; G. A. McNamee, secretary Canadian Automobile Association; Dr. Desaulniers, M.L.A., director Canadian Good Roads Association; A. L. Caron, president Automobile Club of Canada.

Intermunicipal Collection Sewer

Messrs. Gibeau, Drinkwater, and St. Marie, engineers, representing the districts of St. Lambert, Montreal South, and Longueuil, have been appointed by the Quebec Public Utilities Commission to report on the proposed intermunicipal collection sewer ordered to be constructed by the Provincial Board of Health. Plans have already been drawn up by the later Board, and St. Lambert has completed its section. The Harbor Commissioners are also prepared to construct a sewer for their land, while Longueuil objects to the outlet of the latter sewer being placed above the intake of Longueuil's water supply. The engineers will submit plans, estimates, etc. of the cost of the construction of the sewer, both within and outside the limits of the Harbor Commissioners' leased land, and of the outfall. The municipalities are willing to co-operate, and the question arises as to the apportionment of the cost. The Public Utilities Commission reserves the right to appoint a consulting engineer to report on the entire project.

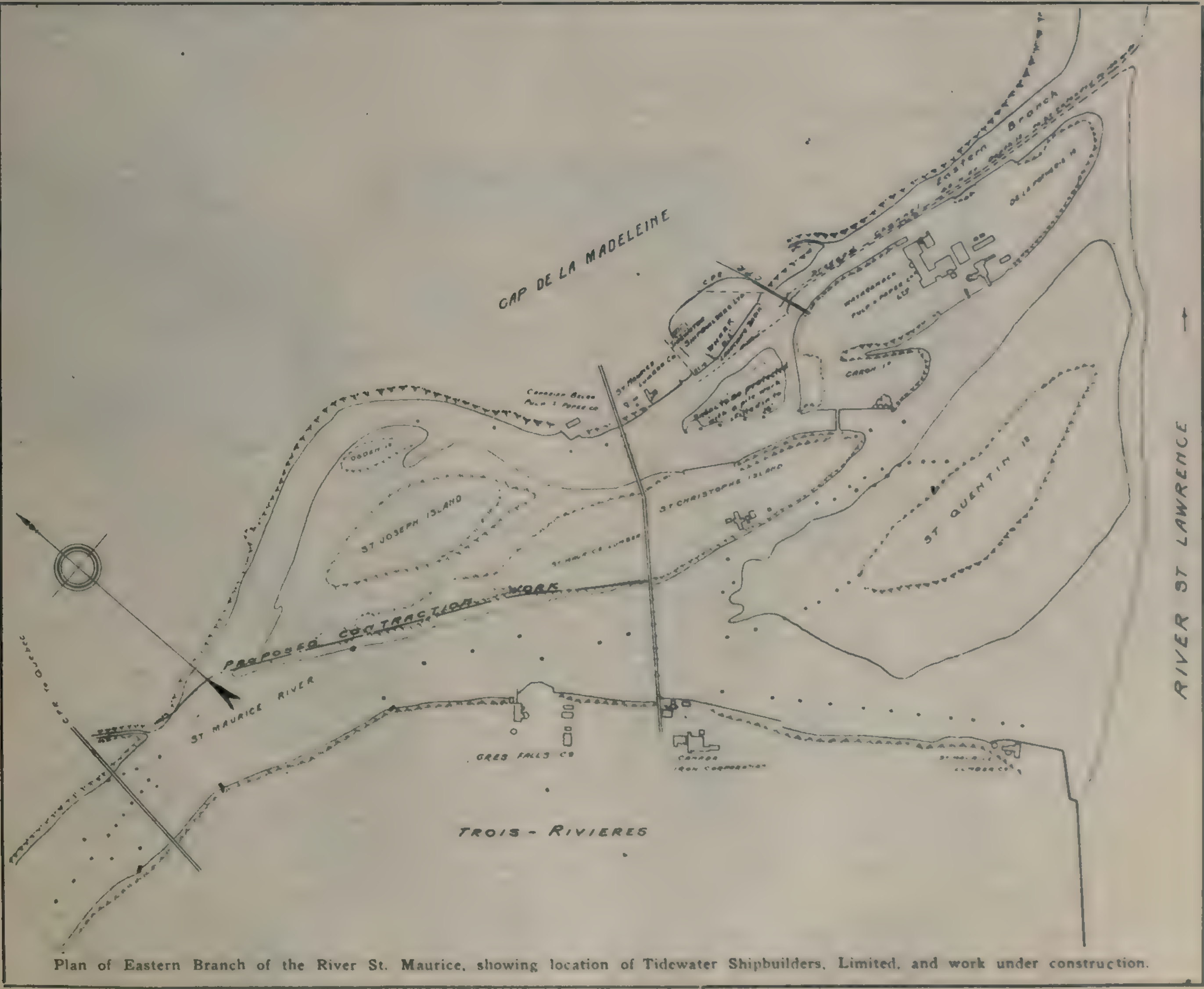
Large Addition to Plant of the Tidewater Shipbuilders, Ltd., Cap de la Madeleine, P.Q.

THERE has been unusual activity along the Eastern Branch of the River St. Maurice during the last season, especially at the plant of the Tidewater Shipbuilders Ltd., at Cap de la Madeleine, which was organized in 1917 for the purpose of building steel ships. This company has built during the last summer one 240-foot steel cargo boat, the "T. P. Phelan," and three 137-ft. trawlers. The trawlers are completely equipped for sea going.

The plant, as first designed, consisted of machine shops and a mold loft erected in 1917, but a contract with the Government to build four 5,100-ton steel cargo boats, to be delivered during 1919, made new extensions necessary. The general contract for the erection of this plant was awarded to Messrs. Anglins Ltd. of Montreal.

Harbor Improvements

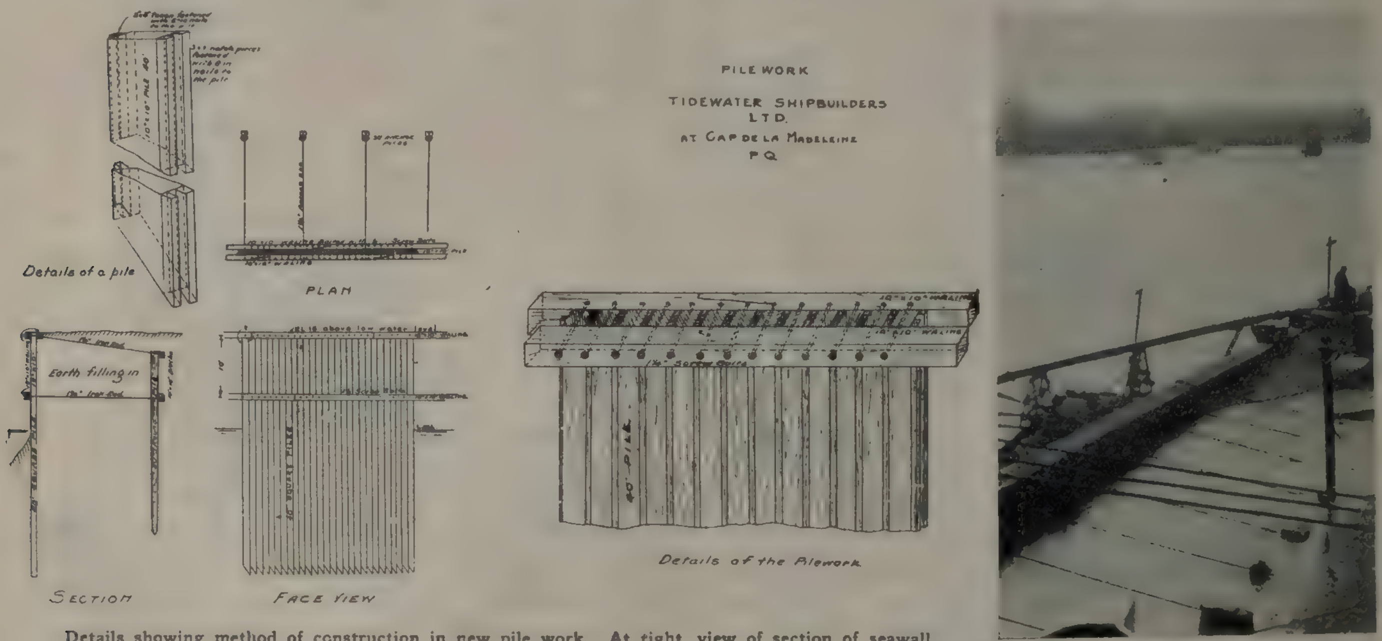
Improvements to the harbor became absolutely essential as the eastern branch of the river St. Maurice was offering only a shallow pitch to the navigation. The dredging of a launching basin and the opening of a channel from the company's property to the St. Lawrence River were urgent. The company applied to the Government and succeeded in interesting the latter in its operations. A preliminary examination of the site and the importance of the work proved that the need for dredging the whole area from the sand shoal, represented on the general plan, as protected with a pilework filled in to 16 feet, to the company's proposed wharf, as well as the opening of a 100-foot channel at the bottom from the C.P.R. bridge to the St. Lawrence River, was not exaggerated. This involved the removal of some 500,000 cubic yards of material which was considered too big an undertaking for the first year, and they set the lines of the basin at one foot distance from the proposed wharf and the opening of a forty-foot channel below the C.P.R. bridge to the St. Lawrence River. The depth contemplated was 15 feet at the lowest water



Plan of Eastern Branch of the River St. Maurice, showing location of Tidewater Shipbuilders, Limited, and work under construction.

mark corresponding to 15.92 feet above the mean Atlantic level, plus the allowance of one foot as subgrade. This reduced the estimates to some 200,000 cubic yards. The excavation consists chiefly of sand and hard clay. A contract was entered into with the "Laurin & Leitch Engineering & Construction Company, Limited, of Montreal," and the Department of Public Works, Canada. The company sent their "Dredge No. 4" to the site and the work was started in the early days of August. The draught of this plant was over seven feet and the water level was at a low mark on the gauging scale.

Work on the basin was the first to be undertaken as there was not enough water to float the "T. P. Phelan." The first problem which confronted the contractors, besides the shallowness of the basin, was the narrowness of the navigable surface above the C.P.R. bridge. The dredge had to prepare a convenient area to permit the tug to turn and approach with her scows. The operation was carried upstream and proved difficult, as in removing each shovelful a portion of the removed material was washed out and carried back to the cut. The type of dredge used was a dipper with a thirty-foot boom. The depth of face-cut was approximately ten feet and soundings taken during the operations show that approximately 25 per cent. of the disaggregated bottom had filled in the cut. The stream velocity was one mile per hour, measured by the float method. The contractors were now forced to come back and resume their work on the whole surface of the basin.



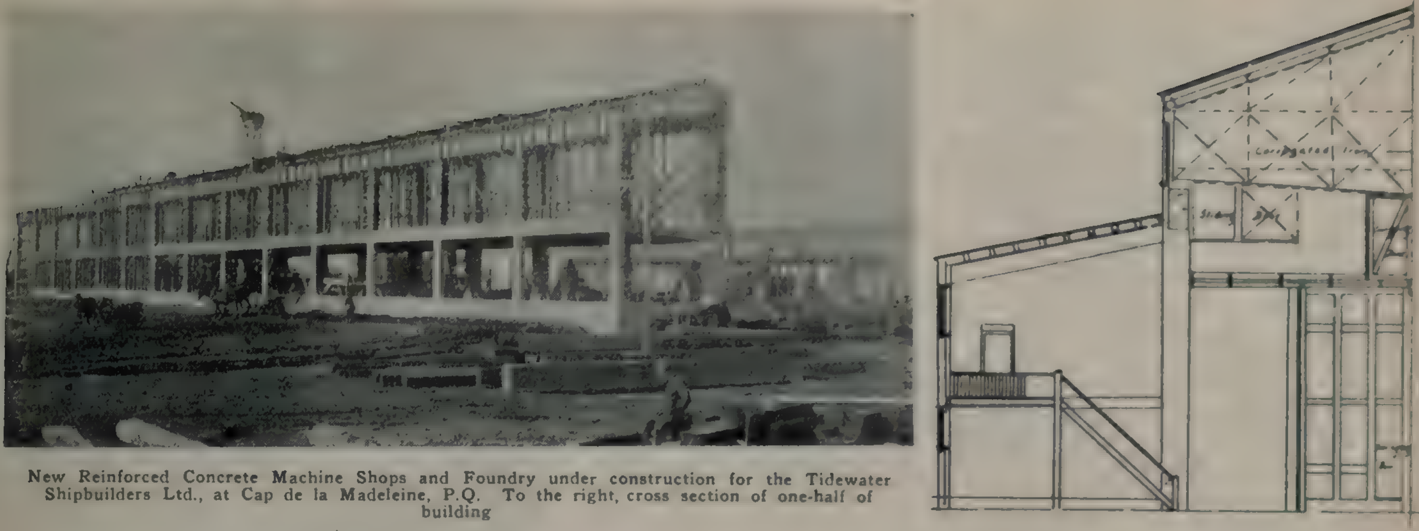
Details showing method of construction in new pile work. At right, view of section of seawall

Such troubles can be considered as a great disadvantage, the plant's energy being spent in shaking the materials which could not be handed to the scow. This delayed the progress of work as well affected its results. Later, the opening of a channel for the "T. P. Phelan" was undertaken as well as the dredging of launching basins for the trawlers. The last operation, including the dredging of a forty-foot channel to the St. Lawrence River. The general contractors sub-let a contract to the Department of Public Works, Canada, which sent the dipper dredge P.W.D. No. 116 to perform a portion of this work. The channel is now completed, dredge No. 4 has returned to the basin and is completing the sweeping of this latter. Exception must be made for the upper section of the basin, which has been undertaken by the Tidewater Shipbuilders Ltd. This company uses the excavated material to fill in its wharves and level its property. For this purpose, they have converted a large scow into a suction dredge, equipped with an electric motor and a twelve-inch pump. A cutter was attached in front of the head boom, through which passed the inlet pipe. The outlet pipe was carried on a series of one-ply booms spaced fifteen feet, centre to centre and reached the wharf some three hundred feet distant. It is located near the sand shoal shown in the background in the illustration. Wooden trestles were used to carry the pipe, the daily capacity of which is estimated to be 2,000 cubic yards. The electricity is supplied from the transformers in the yard by means of a temporary transmission line. The dredging operations were under the supervision of Mr. J. J. Collins. Civil Engineer.

Since 1884 the quantity of material removed from the different branches at the outlet of the river St. Maurice is 1,894,936 cubic yards involving an expenditure of some $310,593.00. This has been done without any very favorable result. The writer has always been a zealous advocate of undertaking the work at the outlet. This latter should be reduced to the width existing above the C.P.R. bridge on the main line to Quebec. For this purpose he would suggest the closing of the Eastern Branch by a dam as shown on the plan so that this branch might be filled in by the backwater from the St. Lawrence River.

Sea Walls.

The company has undertaken the construction of a sea wall to protect its property against any sliding, also a wharf for the handling of machines to the boats undergoing equipment. The work is done by day labor, under the supervision of their own engineer, and was started by sinking the pile foundation for a concrete footing to be used to carry a large derrick. This foundation is composed of four rows of 30-ft. piles sunk every four feet, centre to centre, after which they proceeded with the sinking of piles in front of



New Reinforced Concrete Machine Shops and Foundry under construction for the Tidewater Shipbuilders Ltd., at Cap de la Madeleine, P.Q. To the right, cross section of one-half of building

the trawler No. 1, this vessel was nearly completed and the wall was not considered strong enough to withstand the pressure due to the weight of the boat. The engineer adopted a method which consisted of driving six-foot posts twenty feet back from the wall and tying them to the wall with ¾-inch chain. This was efficient and the structure resisted well to the pull exerted by the sliding trawler along her bedway.

The wharf is located at the western part of the property and extends eastward some three hundred feet. It is built as shown on the plan, at elevation 16 feet above the lowest water level as observed in 1897. It is composed of a series of square piles 10 in. x 10 in. x 40 ft. of pitch pine sunk at closed join. The joins were made with added pieces 3 in. x 3 in. running the whole length of the pile so as to form a tenon or a groove. These pieces are fastened to the piles with iron nails.

At the top of the sea wall, two walings 10 in. x 10 in. spliced at every twenty feet, run parallel on each side of the wall. They are well bolted at every foot longitudinally with 1¼-inch screw bolts, with the heads, nuts and washers embedded in the timber. Another single waling is used as a fender 10 feet below the top waling and is bolted in the same way. Twenty feet back is sunk a row of round piles 30 feet in length, placed alternately to the wall and spaced ten feet from one to the other. They are sawn at 13 feet above the lowest water level and connected to the wall by 1¼-inch tie rods bolted in a wooden square block to protect the head of the pile.

The second part of the sea wall is some 900 feet in length and has been designed only as a protection wall for the property. It is built five feet above the lowest water mark and is constructed of 10 in. x 10 in. x 30 ft. piles driven in the same way as those for the wharf, with the exception of the lowest waling or fender, which is excluded. It is built so as to receive any bedway which the company may contemplate in the future. The piles have been driven with a 2,000 pound pile driver, 30 feet high, operated by a steam winch. The work was started during August and is now completed. The lumber for this construction was received both by water and by rails.

Extension to the Plant

The building under progress at the Tidewater Shipbuilders Ltd., is the first of this type to be built at Three-Rivers, or in the vicinity. It is of reinforced concrete construction, 250 feet long, one hundred feet wide, and comprises a main bay and two lateral bays. The main section is some fifty feet high at the center. One-half of this building will be used as a boiler shop, and the other half as a machine shop. In each section, the main bay is designed so as to receive a horiontal 35-ton travelling crane, which will run on 80-lb. standard rails placed on top of the concrete crane girders provided therefore, for the full length of each side of the building. The rails have to be joined by standard spliced plates punched through the webs at 5 feet centres for anchors, and secured in place by 5/8-inch anchor bolts built 18 inches into the concrete with guide and lock nuts. The end extending into the concrete is ragged to ensure a firm hold.

Railway Supplies Materials

As may be seen from the layout plan all the materials are received by railroad at one end of the building and have to be conveyed by horses and wagons to the proper place. The mixing plant is placed adjacent to the track. A one and one-half cubic yard mixer is used. The concrete is taken from the mixer to the form by means of wheelbarrows, through an elevator, the mixer and the elevator being operated by steam. The work was started during September, and the principal difficulty experienced was due to the heavy rains which fell during this month and filled the trenches causing delay in the work.

Forms

All the wood forms, including those for the footings, were made in sectional panels on the site. These forms necessitated the ordering of some 100,000 feet B.M. of spruce.

Footings

In the footings and foundations the concrete mixture was one part cement, eight parts of aggregate, sized to pass through a 1½-inch mesh screen, except where otherwise specified.

In the footing under the wall column the reinforcement consists of six ½-inch square bars, spaced 9 inches lengthwise and 6½ inch square bars, spaced ten inches crosswise. Under the main column it is composed of 11 ⅞ inch bars, spaced 9 inches lengthwise and 9 ⅞ inch square bars spaced 12 inches crosswise. In the footings for columns larger than 14-in. x 18 in, and beams larger than 14 in. x 20 in., the concrete mixture is one part of cement, six parts of aggregate, sized to pass through a 1½ inch mesh screen.

In columns 14 in. x 18 in. and beams 14 in. x 20 in. or less, and the floor slabs, one part of cement, six parts aggregate sized to pass through a ¾-inch mesh screen. Reinforcement for the beams, girders, slabs, is furnished by the Trussed Concrete Steel Company. Provision has been made for column guards of 3 in. x 3 in. x ⅜ in. steel angles to extend four feet above the ground floor and secured with six anchor bolts.

All the steel and the iron exposed to the air is to be painted with graphite paint.

The roof structure is of structural steel, which is supplied by the Dominion Bridge Co. and the roofing will be composed of a layer of a saturated building paper covered with one layer of a two-ply paper "Ruberoid" roofing material guaranteed for ten years.

The illustration shows the progress of work on the 1st of November, 1918. It is expected that this building will be completed soon, although labor is difficult to secure at Three-Rivers.

In connection with this building, a sub-contract has been awarded to The Metal Shingle & Siding Company, Montreal, for the roofing, and to the Elbert Mapes Co. Montreal, for the painting and glazing.

The architects are Messrs. Barrott and Blackader, Montreal.

Mr. R. Grant is supervising the work of the general contractors.

Letters to the Editor

Reinforced Concrete Highway Bridges and Their Architectural Treatment

New York City, November 29, 1918.

Editor, Contract Record:

Due to the rapid development of motor truck transportation which America is to witness within the next few years, it is evident to all, who are giving the subject of highway bridges mature consideration, that it will be necessary to erect many new bridges to replace those which are at present lacking in strength to carry loads to which highways will be subjected. The publication of Mr. F. G. Engholm's able article entitled "Reinforced Concrete Bridges and Their Architectural Treatment," in the November 6th issue of the Contract Record is, therefore, very timely.

Highway engineers, officials and bodies of laymen having supervision of the construction of highway bridges should give this article special attention, should absorb its recommendations, and, thereafter, should emphasize in public intercourse, the salient points so strongly brought out by Mr. Engholm.

Reinforced concrete highway bridges would, under practically all conditions, be materially improved if finished in some manner other than with the plain surfaces of ordinary concrete. Too much emphasis cannot be placed on the proper selection of the surface aggregate and the method of finishing. Likewise, the color scheme should be given careful consideration. Highway bridges, whether in cities, villages, or in rural districts, should be so designed that they will harmonize with their environments.

The time is near at hand when the slogan "See America First" will be taken up by thousands of motorists. Localities blest with beautiful natural scenery will draw tourists and thus the business interests of those communities will be materially benefited financially. In certain locations, except in cities and parks, the utilitarian official will question the economic advisability of the comparatively small extra cost of substituting an artistic structure for an eyesore. Far-sighted officials, however, will not mar nature's beauty by the erection of incongruous structures. As an example, will be cited the results attained by the Board of Water Supply of the City of New York in the area to the south of the Catskills in the State of New York. The Board has constructed around the vast Ashokan Reservoir a system of winding highways and artistic reinforced concrete bridges which harmonize with the natural beauties of the surrounding landscape. As a result, the Board has been credited with having built one of the most famous scenic highways in the eastern part of America.

From the standpoint of serviceability and appearance, the roadways of highways and bridges must be of a sufficient width to easily carry the traffic to which they will be subjected. A common practice has developed of building bridges sixteen to twenty feet, in the clear, between railings or truss members. Considering the rapid development of motor truck traffic and the fact that many motor trucks have overall widths of between eighty-five and ninety-five inches, it is evident that the minimum clear usable roadway between guards should be not less than twenty feet for two lines of traffic. Guards should be used to protect the railing or truss members and should have a width of from eight to twelve inches.

Reference will be made to one other detail. The lines of the construction arch at the crown of flat arches should not be reduced by extending the architectural treatment of balustrades or parapets below the arch ring as otherwise an appearance of weakness will be given to the structure. The full strength of the arch ring should be emphasized, as is the case in properly designed flat arches of stone masonry, well known examples being the Wissahickon Arch, Fairmount Park, Philadelphia, the new bridge at Ayr, England, and the Pont de Austerlitz, Paris.

Yours truly,

(Signed) Arthur H. Blanchard.

* * *

Nobody Knows About Toronto Safety Zones

Toronto, Dec. 12, -918.

Editor, Contract Record:

During the last month or so there has appeared in Toronto what seems to be a series of "safety zones" for passengers boarding and leaving street cars on the very wide streets, such as College and Spadina. These take the form of a broad white mark on the asphalt, allowing approximately the length of a street car and about five feet in width. If these are intended for safety zones the idea is good, but fails in effect for the simple reason that nobody seems to know what it's all about. Pedestrains still stand on every part of the roadway, forcing vehicular traffic to drive over the very places that have been designed for the safety of the walking public. On streets where the roadway is twice the width of ordinary thoroughfares it is manifestly unreasonable to expect vehicular traffic to stop for every standing street car, and the safety zone is, therefore, the logical solution of the difficulty. The great fault in this case is that the public have not been told—nor have the motorists or drivers. Surely this is an oversight that should be remedied as quickly as possible—by circular letter to motorists and public advertisement in the newspapers.

Canadian municipalities are lax in all matters pertaining to road traffic regulations. At the busy downtown corners in Toronto, paths for pedestrians across the streets are indicated by these same white lines and motorists respect the ruling that they must stop behind these lines until traffic is ordered through by the traffic policeman. In the busy centres in the United States pedestrians do not attempt to cross when vehicular traffic has been given the "go-ahead" signal. In Canadian cities there has been no effort whatever to educate the public in this regard and bicycles and pedestrians cross the roadway indiscriminately in the path of moving traffic.

We are also negligent in the matter of providing "right and left" traffic signs which are used so extensively, and with good effect, across the border. Our vehicular traffic is allowed to cut corners with perfect freedom, constituting often a great menace to traffic approaching from the opposite direction. Wide-awake United States cities long ago banned the glaring headlight—still we Canadians blunder along, permitting its indiscriminate use and attendant danger.

How long is it going to be before our authorities wake up to the fact that the traffic problem has outgrown its puppy days? How long will it be before we are provided with sane and just traffic regulation? A system that supplies plain clothes men to skulk in doorways and behind trees on deserted streets to catch the unwary motorist, and yet allows him to speed to his heart's content on busy down-town streets; a system that permits the glaring headlight and the danger of the unlighted bicycle and horse-drawn vehicle; a system that permits cutting corners from every angle; a system that encourages pedestrian traffic to stand in the path of vehicular traffic and many other inconsistencies, is surely in need of overhauling.

Yours truly,
C. G. Thomas.

* * *

West Requires Marked Increase in Building Activity

Winnipeg, Man.

Editor, Contract Record:

Winnipeg and Western Canada must now take up the reconstruction work necessary to give remunerative, congenial employment to her gallant heroes, who are now to be returned and enter the various vocations necessary to set the wheels of progress going.

We, who have been entrusted with affairs at home, have marked time for the past four years, allowed interest and tax payments to run behind as far as the law allows without sacrificing the properties. This, in most cases, has been necessary, that we might carry on that greater work, more essential to our fighting men, that they might win the victory that would make life, not only in Canada, but throughout the world, worth while.

Our present needs in this great Canadian West are that the Dominion Government lend us their aid in procuring the money and credit required for every legitimate undertaking that has been held up in the past, or that is, or may be, planned for present or future needs. The erection of and additions to hospitals, prisons, insane asylums, court houses, town halls, charity homes, bridges, sewers, roads, and the many other improvements that must be done by the governing bodies, should be proceeded with at once. This will create a demand for the labor of our returned men, who, in turn, will require homes, which must be built, and this will be the second phase of our reconstruction. In many homes to-day the mother, daughter, and daughter-in-law, are all housed under one roof, while the three bread-winners are overseas doing their bit. When these men return, they will want to return to pre-war conditions, each family occupying their own house. This means the filling up of the vacant houses we now have, and the erection of many more, if the past is any criterion to judge from.

Building and allied industries for the last three years have proceeded along a war-time level, which, for the city of Winnipeg, meant two million dollars' worth of permits. With the increased needs of soldiers returning home, there must be a marked increase in building to supply the demand. The Government must start the wheels of progress and withdraw as soon as their undertakings begin to compete with the erection of the necessary homes and undertakings of the public.

The cost of structural material will have a downward tendency even if labor should be held at the high level of 1918. Labor will be more efficient, many labor-saving devices have been, and many more will be added to farm and factory, which should and will reduce prices. Labor hours will be shortened, and if the men in charge of affairs manage to keep everyone at work, producing to the extent of their desire and ability, we shall have abundance for ourselves, and much to spare for our needy Allies across the sea.

(Signed), W. P. Alsip, President,
Alsip Brick, Tile and Lumber Co.

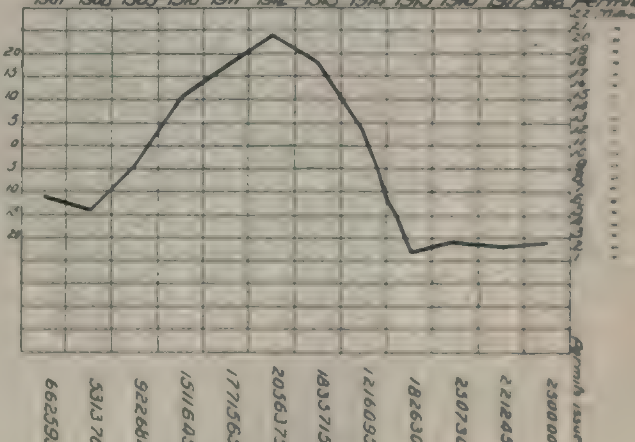
* * *

Salient Points Discussed by Winnipeg Contractor

Winnipeg, Man.

Editor, Contract Record:

To the men charged with the work of mapping out our policy of reconstruction should be given the most earnest support of our public and trades' organizations, and our people. Our united effort in the four years of terrific struggle just ended has resulted in a success that has surprised ourselves and given us a position and excited admiration from all civilized nations, and the same will win us a wonderful development and a doubled population of contented people in the next ten years, and a determined effort now to keep industries increasing their output and farmers



Winnipeg Building Permits, 1907-1918

increasing their products will mean more people employed at good wages and this will result speedily in more and better housing for our people.

The return of our men overseas will much more than tax our present housing ability; therefore more houses will be needed next year, and very many more in 1920, when there will be an urgent demand also for office space and warehouse and factory extension.

Private enterprise may go slow and feel its way cautiously for a short while, and during this period, public work of every description should be pushed to the limit. Dominion Government work should lead the way; provincial highway commissions should do much bridge and road building, and our city authorities should begin repairing and rebuilding the streets and pavements, which, after four years of retrenchment during the war, are in bad need of repair if they are to be saved from the scrap pile. New sidewalks would in many instances be cheaper than the constant effort to keep old wooden walks in repair, with the added risk of damages through accident. By our public bodies thus proceeding at once with their work the interval of quiet which might exist while private enterprise was getting its start would be overcome and public work then being somewhat caught up, the men would be available for the tremendous expansion which is sure to come.

When it is remembered that Canada absorbed from two to four hundred thousand people from other countries per year without trouble and that the great majority of these came "looking for a job," I think we need not worry over much about our own citizen soldiers coming back; many of them left good businesses and occupations which are awaiting their return, and suffering, during their absence; machinery on hundreds of farms is idle because the boys of the farms are away fighting, while there is a great need for men with just such training as our fellows have received over there in the Engineers, Pioneers, Forestry and other units.

How are we going to cheapen the price of building material to any great extent unless we cut down the lumberman's or brickmakers' pay, and the dealer's margin of profit,for all these things go to make up the price of building materials? Of course the price of many things that went into war material will drop now, but do we want to start reducing wages, thereby starting an avalanche of falling prices, so that having less money in our pockets and a panicky feeling, we will not build houses?

(Signed) W. T. Davidson,
Builder and Contractor.

Houses of Gypsum Have Many Advantages

GYPSUM or plaster paris as the principal building material for dwelling houses is a new development in building that is being advanced by The Ontario Gypsum Co., Ltd. To prove practical and economical qualities of this material this firm is now finishing up a pair of houses opposite their office at Paris, Ontario, which are open for inspection by anyone interested. The walls are of gypsum blocks, cast from gypsum mortar in the form of a double wall, the outside being of three-inch blocks and the inside four-inch blocks with one inch air space between. Each course is tied with wire wall ties at 3 ft. intervals. Joints are broken as in brick construction. The blocks are all cast 24 in. long and 12 in. wide, being cut with an ordinary wood saw for fitting where necessary. The arches over windows and doors are cut skewback by the mason on the job, using an ordinary saw.

The exterior is plastered with two coats cement and lime stucco. Owing to the porous nature of the gypsum blocks it is necessary to provide absolute waterproofing of the exterior wall surface. This is obtained by using hydrated lime as one of the principal constituents of the stucco mortar and is further insured by coating the blocks with a waterproofing paint and by using a waterproofing paste with the finish coat of stucco. The first coat is reinforced with ordinary poultry netting stapled directly on the blocks. The appearance of the finish coat is improved by a pebble dash of red and white pebbles. First and second coats stucco are three parts sand, one part grey portland cement, and one part hydrated lime, measured by volume. The surface is finished by pressing pebbles into the second coat while still soft. The bungalow roof is of wood covered with red asphalt shingles, and the wood trim painted cream color. The bottom of walls from grade line 4 ft. 6 in. high is red pressed brick with black rake joint capped with a cut-stone belt course, on top of which is laid a layer of waterproofing paper to prevent dampness drawing up from the foundation into the gypsum block. Chimneys are of red pressed brick with cement cap and show a projection of 9 in., having a 4 ft. breast tapering to 3 ft. in 4 ft. from the line of the upper storey window sills. The combination of red pressed brick with black raked joints and the stuccoed walls makes a very pleasing color scheme which also harmonizes with the red shingles and cream woodwork.

Gypsum House in Course of Erection

The dividing wall of the two houses, which are semi-detached, is built up of two 3-inch gypsum blocks, making a double wall with 1 in. air space similar to the exterior walls. This wall rests on a concrete basement wall at grade line with waterproofing paper on top of the concrete. The basement is divided into two compartments by a wall of 4-in. gypsum blocks. It is beam filled by cutting blocks to fit, and separates the furnace room from the vegetable cellar. It is also used as a bearing wall for the first floor joists.

It is quite practicable to vary the mode of constructing the walls by building the interior or bearing wall of 4 inch solid gypsum block and finishing the exterior with brick veneer with an air space between. A cheaper type would be to build the outside walls of 4 inch gypsum blocks and finish the exterior with stucco, as described, then nail 1 inch furring to the inside and finish with plaster board and gypsum plaster as later described.. This would be a very practical and economical type for workmen's houses.

The interior partitions are partly solid gypsum block and partly 2 x 4 studding, on which is nailed plaster board to exemplify this type of construction. The ceilings are plaster board nailed to the floor and ceiling joists. No lath or furring is used in this house and the plaster is applied on the inside surfaces directly to the gypsum blocks or plaster board. The gypsum hardwall plaster used, being of the same material, bonds perfectly on the gypsum blocks and plaster board, and adds to their strength, also makes an exceeding hard and durable finish.

The plaster board is manufactured by the Canada Plaster Board Co., an associate company, Brantford, factory at Caledonia, adjoining the gypsum mill of The Ontario Gypsum Co. Ltd., from whom they purchase the plaster of paris used in the manufacture of the plaster board. Plaster board is made in sheets or boards, 32 x 36 in. (8 sq. ft.) with two layers of special paper, between which is a filling of plaster of paris, making the finished board 3/8-in. thick. This plaster board is practically a substitute for the lath, and the first coat of plaster, forming a fireproof coating for walls and ceilings. It eliminates the possibility of lath marks and checks or cracks in the plaster, which are always more or less prevalent where wood lath is used because of the swelling and shrinking of the wood, caused by the application and subsequent drying out of the plaster. Plaster board has many practical and economical advantages, which will be apparent when used.

A constant temperature is most easily maintained in this house on account of the quality possessed by gypsum of non-conductivity, so that a house built of gypsum in the manner described would naturally be warm in winter and cool in summer. The waterproofing methods employed insure perfect dryness. The cost is low on account of the cheapness of gypsum, and the saving of time in laying the blocks which are very light. Cast in large units they are quickly laid. A satisfactory nailing ground is provided for the interior wood trim, plumbing, etc., by Merritt spot grounds, which are attached to the walls with unfibred hardwall plaster, so that when the plastering is finished the grounds come flush with the wall surface and hold nails or screws strongly.

A method of saving on cost of cement concrete was demonstrated when putting in the basement work by the use of 1 part hydrated lime to 3 parts portland cement, measured by volume. By this method a satisfactory consistency of mix was maintained, using a great deal less water than usual. The proportions specified were 7 parts gravel to 1 of cement, but 11 parts gravel were used to 1 of the cement and lime mixture. No spading was done, the concrete dumping freely from barrows, saving the labor of one man who usually is required to help empty barrows and spade the forms. The surface came out smooth and the wall was pronounced by the architect to be equal to usual 7 to 1 mix. This saving in cement is said by engineers who have recently investigated this method, to be due to the fact that the less water used (above the minimum of water required to produce a workable consistency) the greater the strength of concrete. The hydrated lime used lubricates the aggregate and makes a workable consistency with very little water. It also serves to keep the coarse and fine aggregate from separating and insures a smooth non-porous surface. This basement, due to the use of hydrated lime in the concrete, has been tested and found practically waterproof. The hydrated lime used is manufactured by The Elora White Lime Co., Ltd., which is also an associated company.

While these blocks will not bear as much weight as brick or wood, per cu. ft., ample strength is provided by the thickness of the walls employed. As gypsum does not expand or contract with varying temperatures, and is the only building material having this quality, there is no danger of cracking, settling, etc. The fire risk is greatly reduced, as gypsum is a non-burning material, largely used in fireproof buildings. By using non-burning roofing and flooring an absolute fireproof building could be constructed at low cost, using gypsum blocks as described above, having the great advantages of being sound proof, non-conducting and non expanding. Gypsum has all the qualities of wood as a building material with the important quality of being practically indestructible. Its use promises to be largely increased as these advantages become better known. W. F. Sheppard, Elora, Ont., was the architect, and J. D. Tindall & Son, Woodstock, Ont., general contractors.

Building Prospects in Montreal and Vicinity

Naturally opinions vary as to the outlook; we are too near the period of the armistice for any sign of a definite trend of events, while the fact that we are in the dead season for building is another reason that makes for uncertainty. Generally speaking, however, men are optimistic—and there is a strong opinion that given a decline in prices, construction will very appreciably increase. Montreal is very short of houses and flats, for the reason, investors state, that with the present level of costs, it is very difficuult to get an adequate return for the money laid out. This has been the attitude of some public companies, who have only undertaken the most urgent improvements, postponing work until there is a chance of reasonable cost.

In one direction Montreal is fortunate—the shipbuilding industry was never more flourishing. Canadian Vickers, Ltd., have received some very important orders on government account, and it is officially stated that the number of employees will be increased from 3,000 to 6,000. At Three Rivers and Quebec, the industry is also prosperous. The cessation of war will release a considerable amount of steel and other commodities for shipbuilding, and we may hope to see a still bigger boom in this new sphere of Canadian activity.

Mining is also expected to profit from the armistice. The mines in all parts of Canada have been very short of labor, and high prices have cut down demands for goods. This is now changed, and there is likely to be a gradual but certain improvement.

Messrs. R. S. and W. S. Lea, Montreal, have reported to the Water Commissioners of the City of Brantford, Ont., on proposed water improvements, including a new intake, gravity supply pipe, filter plant and the remodelling of the present pumping plant.

1805

Admiral Lord Nelson

HISTORY's greatest sea spectacle in 1918 came within thirty days of the anniversary of the world's greatest sea battle. Trafalgar was the world's greatest sea fight because it marked the coming downfall of one more despot of mankind. Napoleon failed to make Paris the Capital of all Europe because he never could invade England. The little guns that hurled cannon-balls from the "Victory" in 1805 were the fore-echo of the guns of Waterloo in 1815, and of the silent surrender of the Kaiser-navy 103 years later. Had Nelson never flung his fleet of wooden tubs from the forests of England at the ships of France and Spain, Wellington's great little armies might as well never have marched. We read that in the action at Trafalgar the four ships "Victory," "Temeraire," "Redoubtable" and "Fougeux" fought so close that they made almost a single deck. Sabre and musket, man to man they fought, and there was Nelson in the midst of them, as he always was. From the mast of the "Victory" still fluttered in the smoke the rags of that immortalizing signal, "England expects that every man this day will do his duty." When Nelson spoke in the name of England it was with a passion that not to obey him was not to know the glory of duty. Master of naval strategy and tactics, he never had time to write a book about it, because he was too busy fighting for England. He knew nothing of politics, like Wellington; nor of statecraft, like Napoleon. But he knew the swish of the sea, the roar of the guns, the coast-lines of Europe from the Baltic round to the Aegean; and wherever he went—after whatever enemy—sailor, daredevil fighter, poet in action, terrible and beloved, he carried with him like a song, "England, My England." Trafalgar was his last word to Napoleon that England must conquer because she could not be invaded.

"Mighty seaman, this is he,—was great on land as thou by sea," wrote Tennyson in his Ode to Wellington. A musket ball from the crosstrees of the "Redoubtable" killed Nelson. But the death of Nelson was the life of England and duty, as Trafalgar was the first sure sign in 1805 of the liberation of all Europe.

H.M.S. "Victory"

1918

Admiral Sir David Beatty

THREE times in four years he had fought them. He had hoped to fight them again—and to a finish. But here in the North Sea, November 21, 1918, was the finish without the fight. Seventy-one Kaiser-ships of the line steaming up the lane of a great nation's navy. Five hundred great guns—any of them at ten miles could have riddled all Nelson's fleet of tubs in 1805—Never a shot! It was his answer to that day when the High Seas Fleet put to the North Sea in 1914 with the King's message, "Capture or destroy the enemy." Perhaps he remembered that twenty days afterwards; he potted five German cruisers off Heligoland; and then he began to wait, prowling in the fog, looking for more ships from Kiel—till on January 24th, 1915, he sank the "Bluecher" and smashed the "Seydlitz" and the "Derflinger" in that 100-mile run—back to Heligoland, when all the "Lion's" gunners had to aim at was a target of funnel-tops and smoke, the size of a threepenny bit. One year and three months more he waited; till May 31, 1916, when in the battle of Jutland the Rear-Admiral's Fleet came at the bulk of the Kaiser-navy that ran when Jellicoe's supports came up—back to Heligoland. Rear-Admiral became Commander-in-Chief and waited again; shuffling his great mystery fleet back and forth in Scandinavian mists, nobody unofficially knew where—till the morning of November 21st, 1918, he put to sea in the "Queen Elizabeth." What a sight greeted him! The dark-grey lines of the Invincible Navy in the smoke; the six-mile lane; the fog lifting; and out of the low mist from the region of Heligoland they came—abjectly to surrender!

It was "Der Tag" Dead March of the Kaiser-navy; more magnificent in its fitting humiliation to a degenerate race than any surrender of an army. Never a shot, nor a shell, nor a shout. In a great grey silence of miles of monster ships the Kaiser's ensign was hauled down and the sullen sea drama was over. Was Beatty happy? Heaven knows. Three times he had fought 'em, doing his bit to bring one more despot of Europe to his knees. He had hoped to fight 'em again. Here was the finish without the fight. What a finish!

H.M.S. "Queen Elizabeth"

Building Permits in Toronto

Among the projects for which building permits were issued in Toronto the past few months, some of which have already been begun and others which have been temporarily held over, are the following: Canadian Allis-Chalmers Co., Lansdowne avnue and Davenport road, addition to foundry, $70,000; Liquid Air Co., Maria and Boler streets, addition to factory, $18,000; Matthews-Blackwell, addition to packing plant, foot of Bathurst street, $18,000; Bawden Machinery Co., Sterling road, addition to plant, $25,000; Campbell Flour Milling Co., Cawthra avenue, reinforced concrete and storage tanks, $130,000; Palm Olive Soap Co., Carlaw Ave., boiler room and chimney, $18,000; B. F. Johnson Soap Co., Carlaw Avenue, addition to factory, $25,000; National Iron Works, Cherry street, addition to foundry, $15,000; C.P.R., addition to engine house, foot of John street, $35,000; Turbull Elevator Factory, Richmond street west, $20,000; Harris Abattoir Co., addition to cooler building, $75,000, rebuild refinery, $13,000; Page-Hersey Iron Tube and Lead, Church street, office addition, $12,000; Fairweathers Limited, four-storey building, 88-90 Yonge street, $120,000; I.O.D.E., addition to Convalescent Hospital, Sheldrake boulevard, $35,000; International Business Machines Co., Royce and Campbell addition to factory, $40,000; Universal Tool Steel Co., Dufferin near Springhurst, addition to factory, $36,000; Wilson, Lytle, Badgerow & Co., addition to factory, $22,000.

Ask Government to Control Gas Industry

The Council of Galt, Ont., has forwarded a resolution to the Provincial Minister of Lands, Mines and Forests, Hon. G. Howard Ferguson, recommending that the government take over control of the natural gas resources of the province. The resolution runs as follows: That in the opinion of this Council the natural gas of the province is so valuable a resource that it should be owned and controlled and the selling price fixed by the people and not by private interests; that the interests of consumers—both domestic and commercial—will be much better served by the adoption of a government-ownership plan such as that of the Hydro-electric Commission; that government expropriation of existing wells and pipe-lines is desirable; that while the proposed Government plan of a Natural Gas Commission is a step along progressive lines, it does not go far enough, as in an advisory committee composed of producers, distributors, and consumers the representatives of the producers and the distributors, by reason of their superior knowledge of facts and figures, will be able better to plead their case than those representing the consumers, with ultimate harm to the latter; and that the Government be urged to thoroughly investigate the matter of gas purification and the entire problem of a more economical combustion of natural gas."

Town Planing Conference Early in New Year

The Third Annual Town Planning Conference of South Western Ontario, which had been arranged to be held in the Royal Connaught Hotel, Hamilton, Dec. 2-3, has had to be cancelled on account of the influenza epidemic. Probably early in the New Year, however, plans for this convention will be proceeded with. The programme which had been planned promised to be one of great interest, including the following subjects and speakers: "Municipal government, reconstruction and housing"—speakers, S. Baker, City Clerk, London; Sir John Willison, Toronto, Chairman Ontario Housing Committee; Noulan Cauchon, railway engineer, Ottawa; "Housing: Urban and rural"—speakers, Thomas Adams, Town Planning Adviser, Commission of Conservation, Louie Blake Duff, Industrial Commissioner, Welland, Mrs. Dr. S. Lyle, president Women's Council of Hamilton; "Town Planning in relation to housing and land taxation"—speakers, Lawrence Veiller, secretary and director of National Housing Association, New York City, Noulon Cauchon, Ottawa; "Looking Ahead"—Mrs. Dunnington-Grubb, gardening architect, Toronto, Lawrence Veiller, New York City. Dr. Horace L. Brittain, Managing Director of the Bureau of Municipal Research, Toronto, and Prof. C. B. Sissons, Toronto, were also to have spoken.

Buying Houses on Rental Basis

The Toronto Housing Commission has suggested that housing companies might arrange to sell houses on a cash payment of 10 per cent., with the balance in monthly installments extending over a period of from five to twenty years, if the government would buy bonds of these companies, guaranteed by the city of Toronto. The report gives the following table showing the amount of the instalment which would be due on each $1,000 of purchase price in excess of the 10 per cent. paid down, at interest rates of 6, 6½ and 7 per cent.:

		Principal and Interest		
Repayment of Loan in	Number of Monthly Payments	6 Per Cent.	6½ Per Cent	7 Per Cent
5 years	60	19.30	19.53	19.75
6 years	72	16.54	16.77	17.00
7 years	84	14.57	14.81	15.04
8 years	96	13.11	13.34	13.58
9 years	108	11.97	12.21	12.46
10 years	120	11.07	11.31	11.56
11 years	132	10.33	10.58	10.83
12 years	144	9.72	9.97	10.23
13 years	156	9.21	9.47	9.73
14 years	168	8.77	9.03	9.30
15 years	180	8.40	8.66	8.93
16 years	192	8.07	8.36	8.62
17 years	204	7.79	8.06	8.34
18 years	216	7.54	7.82	8.10
19 years	228	7.32	7.60	7.88
20 years	240	7.12	7.40	7.69

Mr. Thomas Adams, town planning adviser of the Commission of Conservation, recently delivered a lecture on "Organization of New Industrial Settlements," under the auspices of the Department of Social Service of the University of Toronto. Congestion and loose or scattered development were equally bad, according to Mr. Adams. He advocated a comprehensive town-planning scheme and the organization of industrial penetration into districts surrounding the city. Industrial settlements should be established on a sound economic basis, and the worker should be provided with a sanitary home as close as possible to his work.

We are just in receipt of the first issue of "Steel Breeze," which, in future, will be issued monthly to air the views of the employees of the Ferguson Steel and Iron Co., Buffalo, N. Y. As its name implies it is a breezy little publication full of information and interest.

Safeguarding Steel Erection

THE Northwest Steel Co. issues the following instructions to employes in order to promote more careful work and decrease accidents to the men. All the restrictions are so obvious and show such good sense that there can be no doubt of their wisdom and of the advantage to be gained by observing them. Many of them apply equally well to various kinds of construction work, especially to the building of houses, factories, and to various kinds of work having to do with derricks and scaffolds. All can be printed advantageously and posted in the shops and yards and on the principal plant of every engineering contractor.

DON'T throw rivets carelessly.

DON'T pass under sling or crane loads.

DON'T leave tools or material on staging.

DON'T fail to keep all safety guards in place.

DON'T violate your employer's safety rules.

DON'T fail to keep clear of lines and blocks.

DON'T injure your fellow worker by your carelessness.

DON'T go onto a staging unless you are sure that same is safe.

DON'T sit or lean on safety rails or braces; they sometimes break.

DON'T throw anything from staging, you may hurt someone below.

DON'T fail to wear goggles, when required; you may lose your eyesight.

DON'T carry spud bars, wrenches, drift pins, bolts, or rivets in your pockets.

DON'T jump from one staging to another; there is always a way around.

DON'T fail to examine all hooks, slings, and other rigging before using them.

DON'T use defective tools; your foreman will furnish you with proper ones.

DON'T fail to report to your foreman when staging or rigging is in need of repairs.

The Canadian Trade Commission

The Canadian Trade Commission, which has just recently been appointed, will have its headquarters at Ottawa, and will co-operate closely with the Canadian Mission in London, with a view to securing for Canadian manufacturers a share of the business arising out of the reconstruction work in France and Belgium and other devasted countries in Europe. Its members are Sir Charles Gordon, of Montreal, who will be chairman, Charles B. McNaught, of Toronto, and H. B. Thomson, of Victoria. In presenting the proposal for the creation of this commission to council, Hon. A. K. Maclean pointed out that for a considerable period after the war it was probable that the purchase and distribution of a large proportion of the Dominion's exportable productions would be carried out through governmental agencies established by the United Kingdom and other allied nations, and urged therefore that it was desirable to establish in Canada a special organization to aid and co-operate with the Canadian Trade Mission in London. An outstanding feature in connection with the scope and powers of the new commission is that it is authorized to select and appoint advisory or associate members with a view to associating with itself any industry deemed advisable.

Fine Record Under Adverse Conditions

Mr. W. H. Mussen, president of Mussens, Limited, Montreal, has issued a circular expressing deep appreciation "to our many friends, and the trade in general, for the very cordial support which has been extended to us in the past, and particularly during the period since March, 1915, when this firm went into liquidation. We feel that you will be interested in learning that we are gradually recovering from the effects due to the falling off of construction work, caused by the war, and are approaching the time when the liquidation proceedings will terminate. We have, up to date, repaid 80 per cent of our total liabilities, and from present indications, it is but a matter of a short time when we shall have repaid the remaining 20 per cent. In other words, we will have done what we started out to do: Carried on the business and paid our creditors one hundred cents on the dollar. While our present favorable position was not attained without some considerable effort on our part, yet, this would have been unavailing if we had not had your generous support."

This is a record of which the company is justifiably very proud, particularly as it has been made during a period of depression in the construction and allied industries. It is one of the comparatively few instances in which a company, very adversely affected by the war, has been able to meet its full obligations.

Annual Meeting of Lime Association

The Board of Directors at its meeting in Atlantic City, December 4, decided to hold the annual meeting of the Lime Association on February 12 and 13, 1919, at the William Penn Hotel, in Pittsburg. Members are requested to report at an early date just who will attend from their respective companies, so that the hotel reservations may be made and other arrangements attended to for the comfort and convenience of members. Further announcements will follow. It is of prime importance that there be a full attendance at this meeting. For further information address the Lime Association, 503 Riggs Bldg., Washington, D. C.

The Mayor of London, Ont., recently announced that the people of that city would probably be called upon to vote on a by-law to grant $100,000 toward the erection of a new medical building in connection with the Western University, at the January elections. A new $23,000 site on the north-east corner of Waterloo St. and Ottawa Ave., has been acquired for this purpose. It is reported that the provincial government is committed to grant dollar for dollar if the ratepayers show their approval of the scheme. When the medical department is provided for, the erection of a new million-dollar university plant is contemplated.

McDermid Bros., 49 Jarvis Street, Toronto, have taken over the business of the Maitland Roofing & Supply Co., and will carry on at the above mentioned address. During the last few years this company has handled some of the biggest jobs in the province, and McDermid Bros. are now ready to execute contracts of any size for roofing and waterproofing, with standard product materials.

Collapsible Pile Driver

A SPECIAL land pile driver used on the Grand Trunk Railway system, has a steel cantilever framework mounted on a flat car and bearing at one end a hoisting engine and boiler and at the other or cantilever end a structural steel tower 8 or 10 ft. high, to which are hinged the wooden leads. When the drop hammer is lowered to the bottom of the leads, the latter are nearly balanced on their pivots so that by the operation of the hoist line the leads can be quickly revolved into a horizontal position with the upper end resting on top of the engine house. The hammer is then moved horizontally to a position between the engine house and the tower, thus holding the leads in stable position where they are locked by pins. The leads can be collapsed for clearing bridges and tunnels in transit or when in collapsed position can be returned to vertical position ready for driving in a very short time.

The machine is equipped with one pair of reversible engines for raising the pile and hammer, one pair for swinging, and one pair for locomotion.

Prosecute Highway Work

Mr. L. W. Page, Director of the Office of Public Roads, Washington, D. C., issued on November 25, to all State Highway Departments a letter urging the vigorous prosecution of all public improvement work and particularly road work, because of the effective means of insuring employment, particularly to unskilled labor in the transition period form war to peace. Mr. Page mentions that during 1919 it is quite probable that more than 100 millions of dollars of State and Federal money will be available for road work and he offers the assistance of the Bureau of Public Roads to the states in dealing with the various problems which may arise.

Moving Pictures of Shipbuilding in B.C.

On the title page of the Weekly Bulletin of date December 9th, there is an illustration showing the laying of keelsons in a wooden ship in one of the great wooden ship-building yards of Canada at North Vancouver, B. C. Moving pictures of all the ship-building operations in British Columbia have been taken by the Exhibits and Publicity Bureau of the Commercial Intelligence Branch and will be exhibited in every country where Canada has Trade Commissioners and Commercial Agents.

The Dominion cabinet has under consideration the public works which will be started this year. It has already been decided to complete the new Welland Ship Canal. This will employ some four to five thousand men. Work is also to be recommenced on the harbor works at Toronto, which had been shut down for reasons of economy, and on the St. John Harbor, the ocean terminals at Halifax, and the Vancouver harbor. Appropriations for all these undertakings will appear in the estimates. Other works are being considered and may be undertaken if it is felt they are needed for the purpose of giving employment, and if they are justified by utility and necessity.

Italy's Building Programme

The Italian government has appropriated nearly three and a half billion lire to carry out its reconstruction programme. One billion, eight hundred million of this amount is to be used for railway construction; one billion for public works and drainage of harbors; five hundred million for other works of public utility, and one hundred million to cope with the unemployment situation.

Hamilton-London Road

The road between Hamilton and London has been taken over by the Ontario government and will form part of the trans-provincial highway. The route followed is through Brantford, Woodstock and Ingersoll. Numerous deputations have been interviewing the provincial premier advocating routes through their several localities from London to the border. The Premier stated, however, that the government would have to be guided by their experts. The work of constructing the highway is to be undertaken at once as one of the means of relieving the labor situation.

All Restrictions on Lime Removed

Edwin B. Parker, Priorities Commissioner of the War Industries Board of the United States, has issued the following statement:

Effective December 1, 1918, all restrictions promulgated by the Priorities Division of the War Industries Board affecting the lime industry are hereby cancelled, and all pledges heretofore made and executed by any member of said lime industry are hereby revoked.

Big Programme for France

France is planning a big after-the-war construction programme, including the reorganization and extension of railway and canal routes and electric power plants, and the elaboration of works at docks and ports. Studies are being made of a scheme for a great international railway route from Bordeaux to Odessa, and the prospect of constructing a tunnel under the English Channel is also being discussed.

Dinner to Toronto Exchange

Mr. W. E. Dillon, President of the Toronto Builders' Exchange, is giving a dinner to the members on Thursday evening, December 19th, in Forester's Hall, 22 College street. It is understood that matters in connection with the recent Ottawa convention of building and construction interests will come up for discussion.

Demobilization may be slow, to prevent unemployment. Maintenance of men in uniform when military necessity ceases is a dead loss. Public money spent now in public work will furnish employment and will result in sure and substantial returns.

Mainly Constructional

East and West—From Coast to Coast

The Tidewater Copper Co. has been incorporated with a capital of $1,000,000, head office at Victoria, B. C.

It has been suggested to the Ottawa board of control that a suitable victory memorial be immediately constructed.

The capital of the Laurentide Sand & Gravel Co., Limited, has been increased $100,000 to $149,500.

A good roads meeting was held recently in Papineauville, P.Q., for the purpose of furthering the Montreal-Ottawa highway scheme.

There is $17,000,000 worth of work to which the city of Toronto is commited, some of which is already in progress, while other portions will be commenced next year.

An interim report for the eleven months of the year, submitted to the works committee of Toronto by Commissioner Harris, shows that the total expenditure of his department was $4,373,398.67, compared with $4,884,421.77 in 1917.

The proposal has been advanced in Brantford, Ont., to erect an isolation hospital for influenza cases as a memorial to those who gave their lives while fighting the epidemic in that vicinity.

The government has decided to make the million-dollar military hospital buildings at London, Ont., of a permanent nature. Originally they were to have been stuccoed, but now it is proposed to face them with red brick.

The South Shore Board of Trade are agitating for the construction of a bridge across the St. Lawrence and will place their claims before the Montreal Harbor Commissioners.

A deputation of citizens from the Leamington district recently waited on the Ontario Cabinet, to request that the most southerly route be selected for the provincial highway, following the north shore of Lake Erie.

The Essex Terminal Railway, a belt-line running through the factory districts of Windsor, Sandwich, Walkerville and Ford, is to be extended to include Amherstburg, 18 miles west of Windsor.

The Province of Manitoba will take advantage of the offer of the Dominion Government to advance funds for the erection of houses. Manitoba's share of the $25,000,000 appropriated would be roughly $1,800,000.

Plans are to be prepared for a new head office building of the Canadian Bank of Commerce, on King street, Toronto, but it is unlikely that any building operations will be undertaken before a couple of years.

The town council of Welland, Ont., have decided to only have temporary repairs made to the bridge over the Welland River, as when the canal is completed the level of the river will be raised six feet, making a new structure necessary.

Grant & Macdonald, Limited, has been incorporated, with a caiptal of $30,000, head office at Vancouver, for the purpose of carrying on business as dredging contractors. The firm is also authorized to carry on a general contracting business, and to manufacture and deal in builders' supplies.

Brantford shows a big increase in building permits. There were 22 issued, at a value of $125,115 for November, while last year the value was only $25,335 for the same month. The total for the first eleven months of the year is $755,705, as against $137,280 for the corresponding period last year.

It has been suggested by the National Live Stock Association that an arena for live stock shows be erected at the Exhibition Grounds in Toronto. A committee of the Canadian National Exhibition Board has been appointed to consider the matter further.

The T. Eaton Co., of Toronto, will, next February commence, in Moncton, the construction of a reinforced concrete building, 240 ft. x 260 ft., six storeys high. It is expected to be completed by the middle of the summer and will be used as a distributing warehouse for the Maritime Provinces.

The Toronto Board of Control has recommended the removal of building restrictions in the central portion of the city, bounded by Parliament, Carlton, College and Bathurst streets, to permit of the erection of three-family apartments to relieve the housing situation.

Preliminary steps were taken at a meeting in Stratford, Ont., recently, to form an association of towns and cities with the object of petitioning the Government to build a second provincial highway following the northern route, since it is known that the southern route is favored for the original highway.

Two concerns propose to establish plants in Ingersoll, Ont., in the near future. The Port Hope File Co. will take over the plant of the Ingersoll Nut Co., Ltd., and will extend it. The Ingersoll Rolling Mill Co. will purchase and extend the Noxon factory and establish in Ingersoll a rolling mill for the manufacture of bar iron.

Winnipeg's building permits for the month of November reached a value of $43,050, as against $26,000 for the same month last year. The total for the eleven months of the year is 1,395 permits, valued at $2,030,800, as compared with 1,219, valued at $2,202,850, for the corresponding period in 1917.

The civic works committee of Hamilton, Ont., have unanimously endorsed a proposal that the proposed provincial highway be diverted from the Brantford-Hamilton stone road through the McKittrick boulevard. Many arguments are advanced in favor of this plan, including the reduced curvature and grading, and it was decided to approach the highway commission in regard to it.

There were 45 permits issued in Montreal during the month of November at a value of $236,425 for new buildings. These included 8 garages, 19 houses, 2 stores, 4 factories, 1 church, a band stand and 2 bridges. The biggest contract was for $42,500 for a factory for the Eagle Shoe Co. In November last year there were 54 permits for new buildings, valued at $164,270.

Building Inspector McKenzie, of Vancouver, reports a total of 49 permits issued in that city for the month of November, at a value of $70,798, including 4 dwelling houses, 6 factories and warehouses, and 2 offices or stores. In November, 1917, there were 38 permits issued, valued at $35,075. The total for the eleven months of 1916 is 778 permits, at a value of $1,358,731, as compared with 525, at a value of $711,960 for the corresponding period in 1917.

Three undertakings of great importance may be undertaken in Hamilton, Ont., in the near future. The surveyors have completed their work in connection with the proposed Red Hill cut-off, by which it is planned to divert the G.T.R. lines from the south side of the city; soundings have been taken for the Toronto-Hamilton highway entrance structure, and the work of taking borings in connection with the McKittrick sewer has also been undertaken by surveyors.

A large deputation from Parry Sound and the adjacent districts recently visited Toronto for the purpose of laying before the Provincial Government the claims of their section of Northern Ontario in connection with good roads, particularly as regards the designation of a provincial highway, of the road from Bala Park northward through Parry Sound, to connect with the provincial road system at Burke's Falls. They also urged the feasibility of the scheme for a provincial highway from Sudbury to Toronto.

The Ottawa board of control has reported against the establishment of overhead or subway crossings at Lyon and O'Connor streets, such undertakings being deemed inadvisable in view of the possibility that at some future date the G. T. R. cross-town line may be removed. The board recommended, however, that a viaduct be constructed over the G. T. R. tracks at Bronson avenue, this work having been ordered by the Dominion Board of Railway Commissioners several years ago.

A new steel bridge with concrete abutments to replace the present structure over the Grand Trunk Railway on Brook Street, Whitby, Ont., has been designed by the railway company's engineers. The north approach at present is 7.32 per cent. and the south approach, about 9 per cent., and the plans for the new bridge call for a reduction of these grades to 5 per cent. and 7 per cent., respectively. The structure, according to the present plans, will be only 20 ft. wide but this does not meet with the approval of the council, and changes will probably be recommended. The season is so far advanced that it will be impossible to proceed with the construction this year, and it is proposed to temporarily repair the bridge at present and to build the new bridge next April.

The war trade board has made the following announcement: "In view of recent developments which have made the steel situation somewhat easier, and especially in view of the fact that certain United States restrictions have been lifted and others modified, permitting shipments of plates, boiler tubes, etc., being made to Canada more easily than in the past, in future it will be unnecessary to apply to the war board for releases from stocks on forms which were provided for this purpose, neither will it be necessary to supply monthly reports as in the past.

"Dealers and others are now at liberty to dispose of their stocks wherever they can but the war trade board reserves the right to fix the price of same in the event of receiving complaints to the effect that prices which are being charged are excessive."

Personals

Mr. Arthur Moss, Chief Engineer of the Hydraulic Service of Quebec, and member of the Quebec Streams Commission, has been added to the Dominion Power Board as a representative of the water power interests of the Province of Quebec. It is stated that arrangements are being perfected for a conference early in February of all Dominion and provincial organizations which have to do with the investigation or utilization of power resources.

Mr. A. W. Campbell, who has been appointed to formulate a scheme of Federal aid to the various provinces for the purpose of road improvement, is advancing the idea of a national highway from coast to coast within the Canadian border all the way. The undertaking considered as a unit, appears a tremendous one, but Mr. Campbell thinks it highly probable that it will be carried out though not all at once. Part of it has already been built, there being a good stone road over the Rocky Mountains.

The Portland Cement Association announces the appointment of Mr. Wm. M. Kinney as general manager, to succeed Mr. H. E. Hilts, resigned. Mr. Kenney has been connected with the cement industry in cement and concrete promotion work for over eleven years, having occupied for the past four years the positions of Engineer, Promotion Bureau and Inspecting Engineer of the Universal Portland Cement Company. He is an associate member of the American Society of Civil Engineers, and a member of the American Society for Testing Materials, and various other societies.

Mr. G. M. Gest, of G. M. Gest, Limited, contracting conduit engineers, Montreal, is managing director of the Sino-North American Company, Limited, organized to promote Canadian export trade. Others connected with the electrical industry who are interested in the company are Sir Herbert Holt, president Montreal Light, Heat & Power Consolidated, and Mr. J. E. Aldred, a director, who is president of the Shawinigan Water & Power Co. The company has opened offices in Pekin, Hong Kong, and Shanghai, and a special representative has been despatched to Vladivostock, to open an office there. Mr. Gest states that special representatives will shortly establish trade connections for the company in the islands of the Malay Archipelago and later the company will enter India. The company represents an important group of Canadian companies—Dominion Textile Co., Ogilvie Flour Mills, Steel of Canada, Canada Carbide, Warden, King & Co., Brandram-Henderson, Dominion Bridge, Thomas Davidson Co., Waterous Engine Works, and Empire Typewriter Co., and is now negotiating with companies engaged in the manufacture of electrical supplies, etc. Regular shipments of goods are being made to the East. The capital of the company is $1,000,000.

Obituary

Mr. L. A. Darey, engaged in railway engineering and construction for many years, died suddenly in Sherbrooke, P.Q., on November 29. He was a native of Montreal, being born in 1865. His earlier years were spent in various parts of North and South America constructing railways; he was also engaged on the Transcontinental, Canadian Northern and G. T. P. For the past four years he was connected with the good roads movement in the province of Quebec.

Mr. C. Legge died at Sarnia on December 1st from pneumonia following an attack of La Grippe. Mr. Legge was latterly connected with the Warren Bituminous Paving Company, for whom he superintended many important contracts thorughout Ontario. He was born at Bond Lake, was in his fortieth year and unmarried. He was a man of quiet, unassuming, but genial disposition, and his high ideals of life and conduct won for him many firm, enduring friendships, especially among men of his own age. In the mining camps of New Ontario where he spent many years, he was held in high regard for his high conception of the square deal. No claim-jumper was George Legge.

Mr. Albert James Hill, a well-known civil engineer and railroad builder, died at his home in New Westminster, B. C., at the age of 82 years, recently. The late Mr. Hill was a native of the Province of Nova Scotia, where he was early connected with the shipbuilding industry. He received part of his training at the Horton Collegiate Academy, where, after his graduation, he was member of the Faculty for two years. He afterwards took up railroad survey work and later turned his attention to the development of coal resources, making a geological survey of the Cape Breton coalfields and carrying out other railway and geological surveys for the local and the Dominion Governments. In 1880 he went to British Columbia in connection with the construction of the C. P. R., and in 1884 went into private practice. Later he became engineer of the New Westminster Southern Railway, and for a time, also, was city engineer of New Westminster. Of late years he has lived in retirement. Mr. Hill was one of the first members of the Canadian Society of Civil Engineers, a member of the Institute of Mining Engineers, and also of other engineering associations of the United States and Canada.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Assiniboia, Sask.
Town Council plan completion of waterworks system and other city work at a cost of $20,000. Clerk, J. R. Nolan.

Barrie, Ont.
Town Council contemplates construction of sewer on Holgate St. Clerk, A. W. Smith.

Chatham, Ont.
City Council contemplates paving several streets in Spring. Clerk, N. G. Merritt.

Esquimalt, V.I., B.C.
Municipal Council contemplates paving Esquimalt Rd. Clerk, G. H. Pullen.

Greater Vancouver, B.C.
Department of Public Works, Victoria, contemplates paving Rever Rd. from Point Grey Boundry to New Westminster.

Hamilton, Ont.
City Council plan construction of roadway and repairs costing $237,000. Engineer, E. R. Gray.

London, Ont.
The City Council has authorized the following work:—asphalt roads, $370,620, reinforced concrete highways, $16,241, and over 21,000 feet of cement sidewalks and 80,000 feet of curbs and gutters. Clerk, S. Baker.

New Westminster, B. C.
Dept. of Public Works, Provincial and Dominion Governments contemplate hard surfacing of pacific highway from here to Blaine, Washington. Minister, Hon. J. H. King, Victoria.

Peterboro, Ont.
City Council contemplates erection of sewage disposal plant. Clerk, S. R. Armstrong.

Quebec, Province of
Department of Highways, Quebec, contemplates gravelling highway between Yamachiche and St. Barnabe, a distance of fifteen miles, at cost of $115,000. Minister, Hon. J. A. Tessier.

St. Catharines, Ont.
City Council contemplates extending Chaplin Ave. Clerk, J. Albert Pay.

St. James, Man.
Town Council plan waterworks extension costing $4,000. Engineer, Mr. Rogers.

South Vancouver, B. C.
Muncipal Council, Engineering Dept., contemplates making improvements to roadways. Clerk, W. T. Riley.

Vancouver, B. C.
By-law will be submitted in January for paving various streets costing $250,000 for City Council, Board of Works, Engineer, F. L. Fellowes.

CONTRACTS AWARDED

Brantford, Ont.
Johnson Bros., 43 Market St., have the general contract for walks, sewers, etc. costing $80,000 for the Lansdowne Park Company.

London, Ont.
Work is to start for sewage and water systems for Department of Public Works, Ottawa: General contractor, Bate McMahon Co., Central Chbrs., Ottawa.

Quebec, Que.
Miles Lonergan, 38 Bourlamaque Ave., has the contract for sewage and water systems at the temporary barracks, Covefields, for the Department of Public Works, Dominion Government.

Railroads, Bridges and Wharves

Brantford, Ont.
By-law will be submitted in January to raise $125,000 for 3½ mile extension of street railway to Terrace Hill. Engineer, T. Harry Jones.

Carman, Man.
Town Council contemplates construction of bridge over Boyne River. Clerk, A. Malcolmson.

Corbetton, Ont.
The Canadian Pacific Railway Head Office, Montreal, Que., contemplate the erection of a station. General Superintendent, A. Purvis, Toronto.

Lacombe, Alta.
The Lacombe & Blindman Valley Electric Company plan construction of electric railway and will require 8,000 lineal feet of tamarac or jack pine piling, 5,000 tamarac fence posts, 26,000 tamarac or jack pine ties, and 500 telephone poles to be delivered during winter. Engineer, H. Warner, Provincial Engineer, Edmonton.

North Vancouver, B.C.
City Council contemplates construction of steel bridge over Second Narrows. Clerk, R. F. Archibald.

Portage La Prairie, Man.
Tenders are being received by the secretary-treasurer, D. McCowan, Portage La Prairie, until December 21, for the erection of three bridges for the Rural Municipality.

Vancouver, B.C.
C. P. Rly. contemplates building extension of railway tracks to connect with new Gov't. wharf and warehouse. Engineer, H. Rindal.

Vernon, B.C.
Department of Railways, Ottawa, contemplates construction of branch line of C. N. R. from Kamloops to Kelowna. Minister, Han. J. D. Reid.

CONTRACTS AWARDED

Sarnia, Ont.
Docks costing $7,000 for Dominion Salt Co., Ltd., Front St.: General contractor, Norris Gibb.

Public Buildings, Churches and Schools

Brantford, Ont.
By-law is to be submitted in January for erection of school costing $70,000 for School Board. Secretary, A. K. Bunnel.

By-law will be submitted in January for erection of memorial isolation hospital for City Council. Clerk, H. F. Leonard.

Burlington, Ont.
School Board contemplates erection of school costing $30,000. Secretary, H. J. Blair.

Claresholm, Alta.
R. Blakey, Parliament Bldgs., Edmonton, is preparing plans for $150,000 dormitory for School of Agriculture for the Dept. of Public Works, Provincial Government.

Coquitlam, B. C.
Municipal Council contemplates erection of municipal hall. Clerk, Robt. Newman.

Edmonton, Alta.
Plans are in progress for stone or brick office building for the Department of Public Works, Provincial Government. Architect, R. Blakey, Parliament Bldgs.

Fern Creek, Alta.
Capbillion S. D. contemplates erection of school in Spring. Secretary, Clyde Cunningham.

Kingston, Ont.
By-law will be submitted for improvements costing $25,000 to fair buildings for the City Council. Clerk, W. W. Sands, M. D.

Lake Edward, Que.
R. C. Wright, Robinson Bldg., Ottawa, has been appointed architect for two family apartment for the Dept. of Public Works, Dominion Government.

Lethbridge, Alta.
City Council contemplates erection of memorial hospital. Clerk, D. D. Duff.

London, Ont.
Department of Public Works, Ottawa, contemplate erection of a $450,000 post office building. Secretary, R. C. Desrochers, Ottawa.

Milestone, Sask.
Municipal Council plan erection of a

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Montreal Builders' Exchange Votes to Become Branch of Newly Formed C.B. & C.I.

The gathering of members of the Toronto Builders' Exchange and representatives of allied organizations in the city at a conference dinner given by Mr. W. E. Dillon, president of the Toronto Builders' Exchange, was one of the most enthusiastic affairs of this kind it has been our good fortune to attend.

The primary object of the meeting was the discussion of the question of the formation of a Toronto District Branch of the Association of Canadian Building and Construction Industries, a complete account of which is given elsewhere in this issue.

Many of those present had attended the recent conference in Ottawa and came charged with the enthusiasm developed at that meeting. Mr. J. P. Anglin, of Montreal, President of the Canadian Association, came up from Montreal to attend the dinner, and give Toronto a report of the formation of the Montreal District Branch. A summary of this report is as follows:

It is recommended (1):—That with a view to stabilizing the building industry the Montreal Builders' Exchange be changed and reorganized as the first branch of the newly-formed Association of C. B. and C. I. (2):—That the basis of reorganization be the three sections which worked for efficiency at the Ottawa convention, viz.: (a) General Contractors and Contracting Engineers, (b) Separate or Sub-Trade Contractors, (c) Supply Firms, Manufacturers, and Producers of Building Materials. (3)—That later each section be divided into sub-sections as the necessity arises.

It is believed that this basis best suits the present condition of the Building and Construction business and that it will permit of the independent working out of the peculiar interests of every section, and yet retain all the benefits of collective action where the aims are common.

The General Contractors' Section should be broadened out to include all contractors engaged in building construction, public works, railroads, ship-building, bridges, dams, roadwork, sewers, etc.

The Sub or Trade Contractors' Section should include all individual trade contractors as well as the members of organized sub-sections such as Mantel & Tile Dealers, Sanitary & Heating Engineers, etc.

The Building Supply Section should include all manufacturers of building materials, dealers and agents handling such materials from stock or on commission.

These various sections also could be sub-divided so that all members engaged in one specific line would form a separate sub-section for the consideration of their peculiar interests.

The Board of Directors of this Montreal branch, which should meet monthly, should be composed as follows: A past president, president, honorary secretary and honorary treasurer, all elected at the annual general meeting; a first, a second and a third vice-president, each of whom shall be chairman, respectively, of his section, and others to be elected by each section, but no section to have less than three or more than five representatives on the board.

Between monthly board meetings the affairs of this Montreal district branch should be conducted by an executive composed of the three elective offices and the three vice-presidents.

General meetings of this district branch and of each section should be held at least quarterly.

The membership of the Montreal District branch of the Association of Canadian Building and Construction Industries should include all present members of the Montreal Builders' Exchange and any other eligible candidates residing in the Montreal District, which shall extend to and include all adjacent towns nearer by rail mileage to Montreal than to any other organized district branch of the Canadian organization.

A committee was appointed to revise the present by-laws of the Exchange and make the necessary changes to bring the by-laws into line with the new conditions arising out of the adoption of the report.

Every man not employed is either a public charge or an idle potential unit.

Government Must Assist in Combatting Unemployment

THE development of public works of every sort should be promptly resumed. The Minister of Public Works assures us that his department is preparing an extensive construction programme and that important work, held up by the war, will now be resumed. This is all right as far as it goes, but the question asked is when will action be taken? We cannot afford to mark time when immediate employment is required and speed is imperative. Nor must building activity rest with the Federal Government alone. Ottawa should be prepared to assist the provincial and municipal authorities to the greatest possible extent to enable them to carry on with their extensive building programmes.

Building and construction work will afford considerable employment, but should the Government rest there? What about the manufacturers who have invested hundreds of thousands of dollars in plant and equipment for the manufacture of war munitions? These munition plants should, and could be, made producers. Europe will require many things that could be turned out in large quantities in these idle plants. It should be the duty of our Government to secure the overseas market to Canadian manufacturers. In addition to finding the market, it may possibly be necessary to, in some way, assist these industries financially. Such an effort on the part of the Government would result in industrial development all over Canada. It would increase our export trade considerably, and would furnish employment to many skilled mechanics whose special training and experience might otherwise be lost.

Speeding Up on a Building Contract

UNDER pressure most things are possible within reasonable limits. This is especially true of building construction. Given the material and labor, an efficient superintendent can make a wonderful showing. Give this superintendant what he requires in the way of plant and equipment and he will apparently give you 100 per cent. in results. This is the time for the construction wizard to step in and take charge of the work. The organization that has previously been considered practically perfect is very soon shot full of holes. Possibly the whole system of handling the work will be altered, but the effect of this change will soon be evident in the results attained.

The contractors' organization is his stock in trade, his chief and most valuable asset. It takes, in many cases, years to develop and perfect, but when analyzed, it is found to be a most simple and smooth running machine, in which every man forms a cool, quick-thinking and quicker acting part.

The urgent necessity of speed in the construction of our big military camps in the early days of the war afforded the contractors an opportunity of demonstrating just what could be done in an emergency. It also convinced construction men that there was no place in the construction field of to-day for the old rule of thumb and blunder-along type of builder.

Efficiency is demanded to-day in all professions, trades and businesses and where competition is keen, as it is in construction work, it is this efficiency that is, more often than not, the deciding factor in the awarding of a contract.

An increasing number of contracts are being let to-day on a percentage basis and in the selection of a contractor, his ability and reputation for getting things done and done in a satisfactory way are of primary importance in the awarding of the contract.

The speed with which the various buildings for the temporary barracks at Rosedale, Toronto, described in this issue, were erected, is a good example of what can be accomplished by an efficient organization.

Partial Exemption for Workmen's Homes

SIR WILLIAM HEARST, at the close of the session of the special assessment committee of the Legislature, recently intimated that the partial exemption from taxation on the homes of the low-salaried workers may be incorporated in the housing policy of the Government. He explained that the principle applied to the exemption on personal earnings might hold good in respect to low-priced worker's homes. This question would be considered in conjunction with the housing scheme, but any action taken would be general in application and not limited to houses erected under the housing scheme.

There seems to be many obstacles in the way of such a scheme which will not help to remedy our present inequitable system of taxation. A wealthy man may occupy a shack or own a hundred of them—is he to be exempt? Or a laborer occupying and owning a property coming within the exemption clause may still have remunerative investment elsewhere. On the other hand there are many men, in straightened circumstances who for one reason or another occupy and hold the title to a much more expensive home than their income justifies. If Sir William succeeds in working out an equitable scheme of taxing the man who can afford to pay and relieving the man who cannot, he will find lots of supporters. If he only provides another vehicle of tax evasion it would be better to let bad enough alone.

Montreal Prospective Building

THE following is a list of Montreal projects which have been held up by the war and which are likely to go ahead in the near future. It is difficult to give definite information as to when these will go ahead, as some of them are contingent on the money being collected and others on the decision of local authorities, but they give some idea of the vast amount of construction work in prospect:

Dominion Textile Co., St. Lambert, $2,000.000 estimated.

Jacques Cartier, P.Q., storage dam, $200,000.

Notre Dame Hospital, estimated cost $1,000,000.

Addition to Y. W. C. A., original estimate $150,000.

Page Wire Fence Co. Limited, Three Rivers, $150,000; will go ahead definitely in the spring.

St. Agnes Cardiens Church, Lachine, $250,000; tenders will go ahead in a very short time.

Roman Catholic School Commission, Verdun, two schools; architect; states they are likley to go ahead in the spring.

Commercial School, Verdun; tenders to be called in a few days.

Westmount Town Hall, costs not ascertainable. The construction of this will depend upon the council's views as to whether it will be advisable to go ahead.

The plans are prepared and the question is to come before the council very shortly.

Gres Falls, P.Q., surveys for the development of this hydro-electric proposition are being made for the Shawinigan Water & Power Co.

Montreal Tramways Extensions. The company have decided to commence the extensions provided for under the new contract with the city. The work was held up owing to the shortage of labor and the impossibility of obtaining steel.

Arena, Montreal. Plans have been drawn for the rebuilding of this structure which was burned down, but so far the company have not been able to go ahead as the Westmount Council would not agree to the building of a garage as part of the scheme.

Back River Hydro-electric schemes. There are two schemes for developing power on the river, but so far they are quite in a preliminary state. One is by J. R. Walker & Co., Montreal, and the other by the Sault Au Recollect Land & Power Co., the estimated cost of which is twelve million dollars.

Montreal Roman Catholic schools. The Commissioners have in view the building of at least four schools; the immediate prosecution of the work, however, depends on whether they can raise the money.

School, Joliette. Tenders have been received for a school at Joliette, P.Q. The architects say that this contract is likely to be awarded in a very short time.

Chemical factory, Outremont, P.Q. Plans have been drawn for a factory for McArthur Irwin & Co. This will go ahead when a pipe is laid to discharge water into the mains.

Children's Memorial Hospital. Likely to go ahead at once.

Letters to the Editor—Building Prospects in the Maritime Provinces

St. John, N.B., December 14th, 1918.

Editor Contract Record, Toronto, Ont.

The best that can be said regarding the building and construction prospects for the immediate future, is to emphasize the viewpoint that the solution of this problem is, first, in the hands of the Federal Government at Ottawa in regard to its most important phases; and secondly, of the various Provincial Governments and large mining and industrial corporations who have fully passed the initial stage of their career.

Were it not for these paramount interests who have shown every inclination to view the present position from a sane and reasonable point of view, my opinion is that the immediate future would look very dark indeed for any development of importance along these lines.

A short resume of the conditions existing during the past three or four years, as far as the Maritime Provinces are concerned, may, perhaps, be of some interest. When one refers to the Maritime Provinces, it is perhaps fair to mention that notwithstanding many smaller cities and towns where considerable war industry has been carried on, the main industries of this nature have centered in the cities of Sydney, New Glasgow and Halifax, Nova Scotia, and St. John, New Brunswick. A very large proportion of the unfinished war material has been provided from Sydney and New Glasgow, while St. John has done her share in providing the finished product for shipment overseas.

The question arises what has been the effect on the immediate future, as far as these Maritime Province centres are concerned? Without a doubt Sydney has prospered, and the steel industries have been working to the limit of their capacity. Notwithstanding this fact, it is common knowledge that the management of the Dominion Iron & Steel Company have not been slow to recognize after the war features, and as a result, large construction work has been under way for some time past, to provide the necessary material for peace times. One may refer, particularly, to the steel rail mill, which, while working on orders for some time past, is now, or will very shortly be, completely equipped for the supplying of steel rails for the railways in very large quantities. One of the largest mills on the continent is also in course of erection for the manufacture of steel plates for the shipbuilding industry.

These two industries are of more than ordinary importance as far as these Provinces are concerned, and will mean that in so far as industrial activity there is concerned, no stagnation is possible in the near future.

We find the same situation on a smaller scale at New Glasgow, where steel shipbuilding itself is being developed, with the prospect of an industry of very considerable importance.

Your readers will recall that about a year ago Halifax suffered a very serious calamity in the explosion which wrecked a considerable portion of the buildings of the city, injured practically all, and wiped out a few of the smaller industries. This naturally resulted in a very active programme of building during the past year, the extent of same being limited only by the labor available for its prosecution. It is well to remember in this connection that had it not been for the enormously large donations which were placed in the hands of the Reconstruction Commission following the explosion, it is exceedingly doubtful whether building to any extent could have taken place, with prices as they have ruled during the past two years. St. John has furnished considerable finished war material, one industry, in particular, having built up an enormous plant which is now prepared to take up after-the-war work, and whose record is an assurance that their enterprise will be concentrated along good business lines.

In citing these indvidual cities one practically covers the ground in this portion of Canada, and the question now arises — what is the relation between the late industrial activity and the building and construction prospects for the immediate future? My viewpoint centres around the knowledge that all that has been referred to, with few exceptions, has been accomplished without any large extention of industrial and housing capacity. The coal output of Nova Scotia has been largely reduced through loss of labor which has gone overseas, the vacancies left in the housing capacity in this industry having been absorbed through demands attendant upon other lines of activity. How then, are we going to house our men when they return, or at least, when a fair percentage of them return to take up their old-time vocations? This naturally brings us face to face with the housing proposition, which is receiving so much attention at the present time, and in this connection I would say that the construction of dwellings on a proper scale under present conditions is impossible without the aid of Provincial and Federal governments, and it is therefore evident that the programme of these governments is bound to be of immense advantage to the building industry in these Maritime Provinces, and I would go farther and say that with the present prospect of high wages and high cost of material, exceedingly little would be done along these lines without such asasistance.

With reference to construction work of a larger nature, a great deal is necessary, and we are led to believe that all necessary improvements are receiving attention at the hands of the various departments of government interested.

We, in the Maritime Provinces, have a fairly important line of railway extending throughout our entire territory, practically all which is now under the direct control of the department of railways, and the Minister of that department has already expressed himself as being in favor of carrying out all needed improvements under a "wide gauge" plan.

In connection with our various ports, much is required in the line of public works, and in this connecton a reference to the speeches of the present minister of that department as recorded in recent issues of your journal, would convince the most pessimistic that all necessary work will be undertaken with the greatest possible despatch.

The summary of this whole outlook brings us back to the first statement, namely, that the immediate future of building and construction prospects is entirely dependent on the various governments and large industrial corporations.

Living is very high, and consequently labor must command too high a price to entice the builder who is depending upon an interest return on his investment, and added to this, all materials entering into buildings may be justly referred to as abnormally expensive at the present time.

It is not my desire to present a pessimistic viewpoint of the situation, as such would not, I believe, be justified, in view of the fact that the various governments are themselves so fully alive to the situation, and if they will follow out their programmes in a fearless and energetic manner, we in the Maritime Provinces have no reason to fear any serious pinch in the transition from war to peace.

(Signed) E. R. Reid,
President, Engineers & Construction, Ltd.

International Masons' Association Meets

The International Boss Masons' Association, which represents 500 master masons in the United States and Canada, at their recent convention in St. Louis, Mo., elected the following officers for the ensuing year: President, Walter W. Wise, of Indianapolis; first vice-president, Geo. Moore, Detroit; second vice-president, J. J. McGarvey, Cincinnati; secretary and treasurer, L. A. Griffin, Cleveland.

It was decided to hold the 1919 convention in Cincinnati. A committee of four was appointed to arrange for systematic co-operation among the members in tendering on work, instead of destructive competition, which, it was stated, had become economically impossible with labor united and organized for collective bargaining.

"Collective bargaining must work both ways," declared Mr. R. M. Gillespie, of St. Louis. "Our bricklayers and hod carriers are thoroughly organized and in order to cope with the situation we must get together ourselves and eliminate cut-throat competition.

"One of the first things we are going to do away with is the famous old slogan of 'estimates cheerfully given gratis.' In future the master bricklayers will charge for furnishing estimates. Our overhead expense has become too large to continue this practice.

"Big business is getting together all along the line and the master bricklayers recognize that in union there is strength. Ours will be co-operative effort for the introduction of systematic and uniform methods of doing business. You might call it a trust, but it will be a good trust—one that will profit the public."

The Canadian representatives at the St. Louis convention were: Herbert Elgie, Toronto; Harry Hayman, London; John Nutkins, London. Mr. Hayman is retiring president of the association.

Mantel and Tile Dealers' Annual

At the annual meeting of the Mantel & Tile Dealers' Association of Montreal, held in the rooms of the Builders' Exchange, with Mr. Fred B. Locker (President) in the chair, Mr. D. K. Trotter, the secretary, submitted correspondence with the Federal Departments of Labor and Public Works relative to the use of certain classes of tile required by the Department of Public Works in a number of public buildings and presently erected, by the Department of Public Works. It was remitted to President Locker, Mr. Andrew Cross and the secretary to continue the correspondence and arrange that all tiles required for public buildings should be sold to and set by recognized tile setting contractors.

Mr. A. E. Wallingford, seconded by Mr. R. S. Muir, proposed, and it was unanimously agreed, to invite the office-bearers for 1919. He urged that the present officers had shown themselves thoroughly capable to handle the many difficult questions that had arisen during the year, and that they were familiar with any of the problems that might arise in the near future.

Mr. Fred B. Locker, in accepting the chair for the second term, thanked the members for their hearty co-operation during the past year, and trusted that the interest displayed by them in their meetings of the past year would be maintained in 1919.

The waterworks department of the city of Saskatoon, Sask., showed a profit of $10,234 for the first ten months of the year. A deficit in the street railway system, however, reduced the surplus of public utilities to $4,699.

Nearly 2,300 members of the building trade unions are listed among overseas men. The number from each of the various organizations is as follows: Laborers, 800; carpenters, 620; bricklayers, 300; steamfitters, 150; plasterers, 300; stonecutters, masons and granite cutters, 200.

Application will be made to the Province of Quebec Legislature for the incorporation of the Quebec and Ungava Railway Co., with powers to construct a line and branches from a point at or near Seven Islands, in Saguenay county, and thence to appoint at or near Lake Menikek and so on to Manitounuk Sound or other harbour on the Hudson Bay. Further application will be made to incorporate the St. Felicien and branches from a point near St. Felicien, Lake St. John county, thence to the waters of Lake Petitsikapou by way of Lake Nichikun.

Temporary Barracks at Rosedale Heights

Record Breaking Construction for Military Emergency—Battery of Twenty-Four Buildings for Toronto Demobilization Depot

ALLADIN and his famous lamp would be pushed to the limit to compete with the organization of the present-day construction men. The erection of buildings over night appears to be an accomplished fact, and is looked upon very much as a matter of course by the contractor. Considerable space in the newspapers and various journals has, from time to time, been devoted to descriptions of the efficient methods employed by our construction men in handling emergency war work, but any description, no matter how good, fails to do justice to the work of our builders. Residents on the hill in the vicinity of Rosedale Heights, Toronto, were amazed one morning to find their view to the south obstructed by a long, two-storey building. Next morning another building appeared beside the one previously erected. This intensive building continued until a battery of 24 buildings appeared, which complete the military barracks.

While the buildings are of a temporary nature, they are built in a very substantial way, of frame construction. Our rigorous winter climate demands a well-constructed building to be habitable during the winter. A wooden shed is out of the question.

Barrack Buildings

The barracks proper consists of eight buildings 232 feet long by 41 feet wide and two storeys high. The buildings are designed with large verandahs at each end and on both upper and lower floors. Access is obtained to the upper floor by outside stairways at either end, as well as by an inside stairs. The illustration shows the layout of one of the barracks. The company sergeant-major and his sergeants have their sleeping quarters in the centre of the building opening into a cross hall. The location of the company stores and stairway are also shown. A partition 7 ft. high runs the full length of the building. This partition is finished with wire mesh extending from its top to the ceiling.

The building is well lighted, about 35 per cent. of the wall area being glass. The sash are of wood made up in four 14 in. x 28 in. lights, glazed with double diamond glass.

The sleeping cots are laid out as shown in the plan, which allows ample room. A shelf is provided over each cot.

Ventilation is secured by means of air chutes extending from the roof to each floor. These air chutes or ventilators are constructed of wood and are made on the site. The vents are made in pairs, one extending to the ceiling of the ground floor and the other to the ceiling of the first floor. A trap door, at the opening of each ventilator, controlled by a cord, regulates the ventilation of each section of the building.

Heating

The buildings are all heated by stoves of the station agent type and supplied by the Gurney Foundry Company, Limited. These heaters are located as shown and are figured to thoroughly heat the building on the coldest day in winter.

Lighting

All buildings are lighted throughout by electricity. The wiring is on the knob and tube system. The drop lights are 40 watt and 60 watt lamps provided with moonstone shades. Where bracket lights are required they are furnished with 40 watt lamps.

The exterior of the buildings is covered with two-ply asphalt roofing over ⅞-inch T. & G. sheathing laid diagonally on 2 in. x 4 in. studs. The inside is of beaver board, wood lath and 15 lb. asphalt felt on 2 in. x 4 in. studs. The roof is covered with three-ply asphalt roofing, supplied by the Standard Paint Company, of Montreal.

The buildings are all built up well above grade. The cross section through the barracks, shown in the illustration, is more or less typical of all buildings. It shows the ground floor 2 in. x 8 in. joists, at 18-in. centres, carried on 6 in. x 8 in. main sills. These sills are supported by 8 in. x 8 in. posts at approximately 7-foot centres across the building and at 10-foot centres longitudinally. The posts are carried on 6 in. x 8 in. mud sills as shown in the drawing. The floors are all double boarded with 15 lb. asphalt paper laid between the boards.

Ablution Buildings

The eight dormitory buildings are connected by ablution buildings. These buildings are 54 ft. x 38 ft. and, like the dormitories, are two storeys in height. The construction is similar to the other buildings and the interior finish is of beaver board. The ablution buildings are completely equipped with modern W.C. and shower fixtures, as well as the usual ablution tables

General view of Buildings, showing progress one month after contract was awarded and sinks. This contract was carried out by W. G. Edge, Limited, of Ottawa. The Agnew Connelly Company, of Toronto, completed the contract for the underground drainage system.

Mess Buildings

Three buildings, 261 ft. x 46 ft., one storey high. furnish accommodation for the men's mess. As shown in the drawing, each building is divided into four sections, each with its own kitchen. The kitchens are located in the centre of the building and each is completely equipped with a refrigerator, ranges, boilers water heaters and sinks. Each building is electrically lighted and gas is installed in each kitchen for cooking purposes. The mess rooms are off the kitchens, as shown, and the men are served on the cafeteria system. A service table, near the entrance to the mess room, between the kitchen and the mess is provided with two sliding doors with weights. As the men enter the building they file past the table where the food is served, and then carry it to the tables. In this way a surprisingly large number of men can be served in a very short time and the food does not have time to get cold.

Heaters are located as shown on the plan and these are sufficient to keep the rooms warm and comfortable on the coldest day in winter. As shown in the elevation, this building is exceptionally well lighted, and all considered the mess rooms are exceedingly comfortable.

The equipment is plain but substantial; no necessary expense has been spared, but money has not been wasted on needless frills. The tables and benches are made in one unit and considerable thought has been expended on this design. It enables the mess orderlies to keep the room clean and tidy with the minimum of labor.

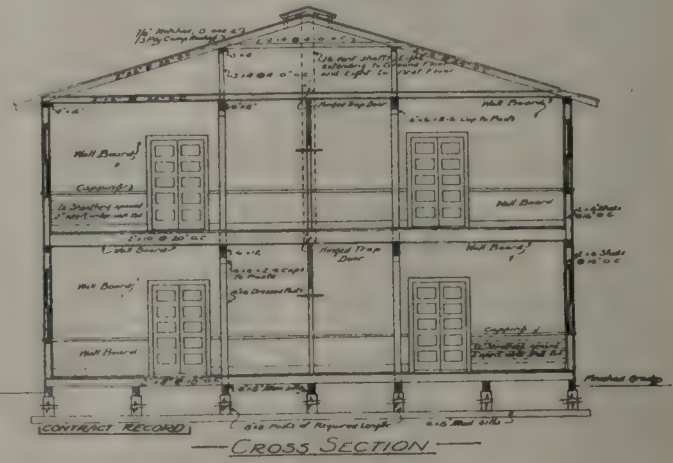
Sergeants' Mess

The sergeants' mess consists of two buildings, 40 ft. x 40 ft. One-half of each building is devoted to mess accommodation and the other half is divided into a kitchen and a writing and recreation room. The kitchen is furnished with a refrigerator, gas range, hot water boiler and sinks. There is also a serving table with two wickets between the kitchen and mess room.

The buildings are lighted with 60-watt drop lights with moonstone reflectors and 40-watt bracket lights.

The building is built up on mud sills placed to a sufficient depth below grade to obtain a solid bearing and where the level of the ground floor and grade will permit the posts are omitted and the main sills rest on the mud sills. The roof is carried on a built-up wooden truss supported on centre posts.

The interior finish is of beaver board and the wall construction is the same as the dormitory buildings.



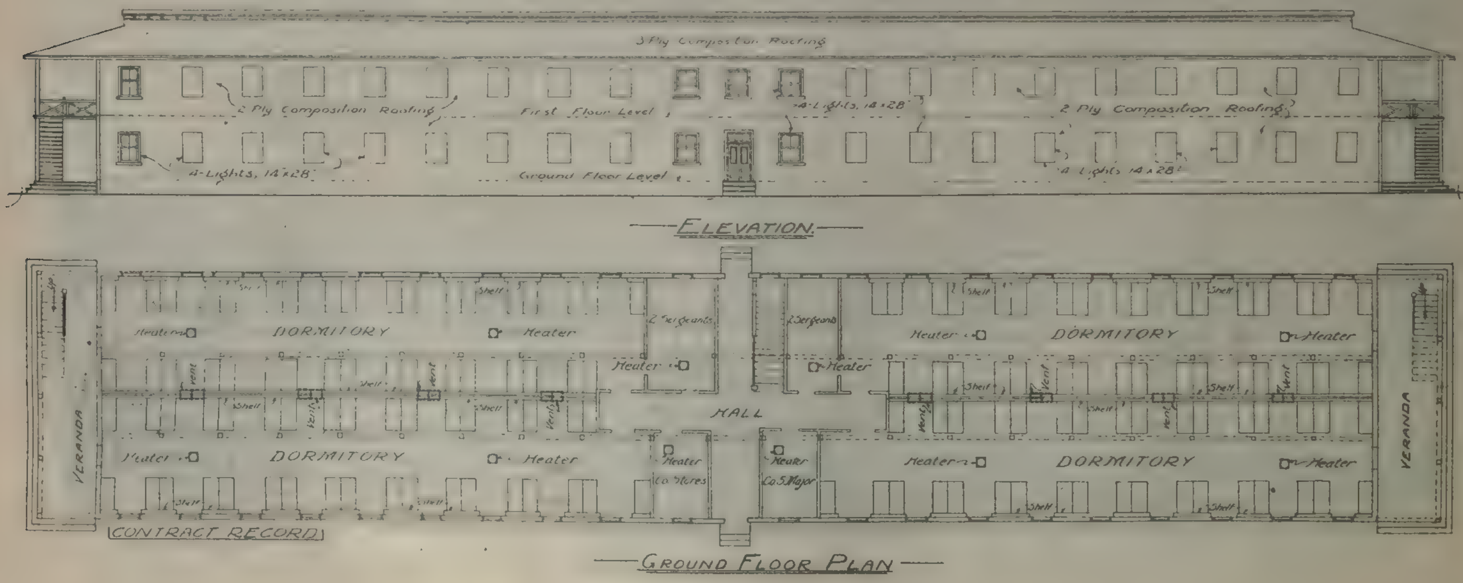
Cross Section through Men's Barracks

Guard House

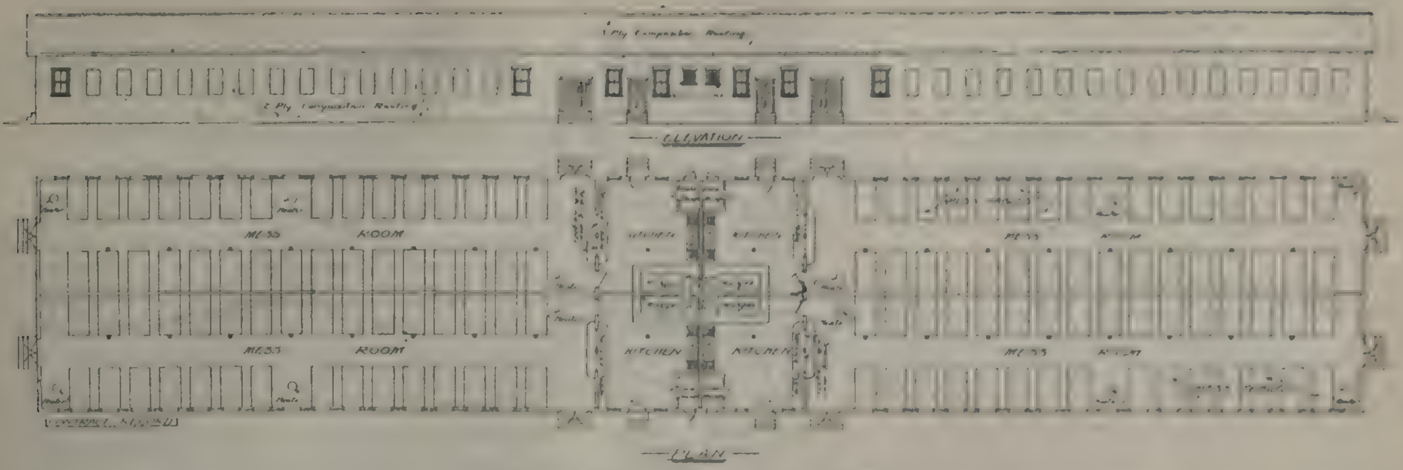
There are two guard houses, 32 ft. x 22 ft. Each has a verandah in front and is laid out with a guard room occupying one-half of the building. The remainder includes three cells on one side of a 4-foot hall and a large detention room on the other side. Each cell is equipped with a bunk and has iron gratings over doors and windows. A lavatory equipped with W.C. and sink opens off the guard room and is built as an addition to the guard house. It is lighted with 40 and 60 watt lamps with moonstone reflectors.

Recreation Building

The recreation building is 98 ft. 6 in. x 40 ft. and is one-storey in height. It contains the men's recreation room, at one end, and the N.C.O.'s recreation room at the other with the canteen and barber shop between. The canteen has serving tables, supported on brackets,



Plan and Elevation of one of the eight Barracks



Plan and Elevation of Men's Mess Building

on both sides to serve either room. The building is heated with station agent type coal heaters and is lighted by 40, 60 and 100-watt drop lights, with moonstone shades.

Company Orderly Room

The company orderly room is 36 ft. x 30 ft. and one storey in height. The clerk's office is in the centre and the four company rooms are off this centre office. The building is finished inside with beaver board and is heated with coal heaters. It is lighted with 40 and 60-watt lamps with moonstone shades. The construction is similar to that of the other buildings.

Quartermaster's Stores Building

The quartermaster's stores building is 60 ft. x 32 ft. and is one storey in height. Twelve feet at one end of the building is partitioned off and divided into three rooms—one as the Q.M. office, in the centre; the others for the tailor shop and shoemaker shop. The main room is for stores and the whole building is sheeted inside. It is heated with coal heaters and lighted with 40, 60 and 100-watt drop lights with moonstone shades.

Administration Building

The administration building is 204 ft. x 55 ft. and is two storeys in height. The ground floor is laid out with a cross hall the full width and length of the building. Opening off the corridor is the paymaster's department, enquiry and waiting room, discharge office, admittance, stenographers, records, C.A.S.C., orderly room C.A.S.C., office of O.C., C.A.S.C., central registry and mailing room. The officers' and men's lavatories are also on this floor.

The second floor has a corridor extending the full length of the building. The offices opening off this corridor include hospital details, orderlies' room, Major Sey's office, A.A.G.'c office, records, assistant adjutant, 2nd in command, officer commanding, stenographers, leave and furlough, legal officer, O.I.C. officers and medical board. The building is heated with coal heaters and is lighted with 40, 60 and 100-watt drop lights, with moonstone shades. The interior is finished with beaver board and panelled.

Officers' Mess

The officers' mess is a two-storey building, 157 ft. x 41 ft. It is divided into two separate mess rooms with a central entrance opening on either side into the mess rooms. The stairway extends from this entrance hall to the second floor.

Each mess consists of a completely equipped kitchen, with the usual store rooms, mess room and ante room. At each end of the building is another entrance and hall with a lavatory opening off the hall.

The second floor is divided into rooms about 11 ft. wide and 17 ft. 6 in. long, opening from a corridor in the centre, which will be used as officers' quarters. A large lavatory equipped with bath, showers, wash basins and W.C.'s, is provided in each section of the officers' quarters.

The building is of similar construction to the other buildings and is heated with coal heaters and lighted with 40, 60 and 100-watt drop lights with moonstone shades. The interior finish is of beaver board and each floor is provided with ventilators extending to the roof.

View showing Framing for one of the Men's Barrack Buildings

There is a large level parade ground extending to the south of the administration building.

Proposed Incinerator

It is proposed to erect a fumigator building 20 ft. x 30 ft., an incinerator 20 ft. x 30 ft., a stable 30 ft. x 30 ft., and a garage 25 ft. x 50 ft. The contract has not been let for these buildings, but this will likely be concluded and work on them started immediately. Provision has been made for the installation of Rudd gas water heaters and tanks in all buildings where hot water will be required. These will be from 40 gal. to 100 gal. capacity.

Painting

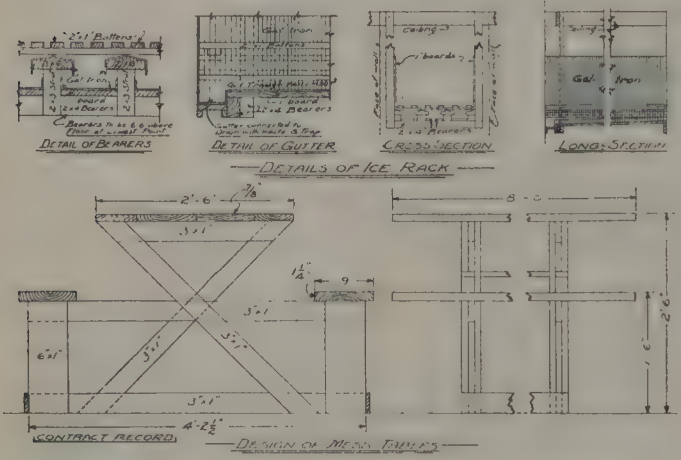
All of the buildings are to be painted a battleship gray. Outside cornices, etc., will be brown creosote stain; doors and floors will be green creosote stain.

Over 3,500,000 ft. of Spruce and Hemlock was required in the erection of these buildings and 400,000 ft. of beaver board was used to finish the interior walls and ceilings.

The McAuliffe, Davis Lumber Co., Limited, of Ottawa, were awarded the lumber contract and the speed of delivery by this firm enabled the general contractors to make the wonderful showing they have succeeded in making. One hundred and twenty-five carloads of lumber delivered in three weeks is one of the records of this contract.

The contractors' plant consisted of one 10 h.p. power feed rip saw, one 5 h.p. swing cut off saw, and one 3 h.p. buzz planer, all equipped with individual motor drive.

The construction work was started on the first of October and the photograph shown in our illustration was taken one month later. This will give a good idea of the rapidity of the work of construction.



Detail of men's mess table and construction of Refrigerator ice rack

Messrs. Ross & Meagher, of Ottawa, Ont., are the general contractors for the whole work. Mr. Meagher stated that the contract will expire on January 11, 1919, and by that date all the buildings will be completed and ready for occupation.

The cost of the work will amount to $330,000.

Concrete Impervious to Sea Water

An American patent has been granted for a method or process of erecting concrete structures claimed to be immune to the chemical action of sea power. The process consists of using flexible sheets of celluloid or a similar material inside the exterior forms. This prevents the absorption of the water in the concrete by the wood forms and at the same time produces an exceedingly smooth surface.

Instead of spading or tamping the concrete from the top, as is usual, the exterior of the forms is tapped or hammered just below the level of the concrete as it is poured. The superior gravity of the concrete under this hammering causes its particles to settle and produce a very compact mass, expelling all air and water, therefore leaving no voids. When the concrete has set the forms and celluloid lining are removed. An outer skin of superior density is thus formed, which will oxidize to lime carbonite, making a surface that will resist the action of sea water. This method should be of particular value in the construction of reinforced concrete ships.

November Building Permits

Activity in the building trades, as indicated by the value of building permits issued in 35 cities, showed a decrease during November, 1918, as compared with the previous month, the total value of building permits falling from $2,850,428 in October to $2,387,045 in November, a decrease of $463,383, or 16.26 per cent. Nova Scotia and Quebec recorded increases as compared with the previous month. As compared with the corresponding month of 1917, there was an increase of 11.07 per cent., the value for November, 1917, being $2,149,223. In this comparison Nova Scotia, Ontario, Manitoba, and British Columbia reported increases.

Of the larger cities, Hamilton showed an increase, both as compared with the preceding month and with November of 1917. Montreal-Maisonneuve, Calgary and Vancouver recorded declines as compared with November, 1917, while Edmonton indicated an increase in comparison with October, 1918, and a decrease as compared with November, 1917. Of the smaller centres, Halifax, Moncton, Three Rivers, Westmount, Brantford and Brandon all showed large increases in both comparisons; Halifax, Three Rivers and Brantford being especially noteworthy.

City	November, 1918	November, 1917	November, 1918, compared with November, 1917. Increase (*) Decrease (†) Amount	Per cent.
Nova Scotia	**345,597**	**$81,373**	***$264,224**	*** 324.70**
Halifax	326,907	35,208	* 291,699	* 828.50
Sydney	18,600	46,165	† 27,475	† 59.51
New Brunswick	**25,050**	**26,903**	**† 1,853**	**† 6.89**
Moncton	22,550	18,403	* 4,147	* 22.53
St. John	2,500	8,500	† 6,000	† 70.59
Quebec	**635,375**	**784,170**	**† 148,795**	**† 18.97**
Montreal-Maisonneuve	339,475	220,555	* 118,920	* 53.92
Quebec	69,050	495,945	† 426,895	† 86.08
Sherbrooke	10,000	53,400	† 43,400	† 81.27
Three Rivers	209,600	12,770	* 196,830	*1541.34
Westmount	7,250	1,500	* 5,750	* 383.33
Ontario	**1,132,664**	**971,142**	*** 161,522**	*** 18.82**
Brantford	129,945	27,346	* 102,599	* 375.18
Fort William	525	11,100	† 10,575	† 95.27
Guelph	5,830	6,545	† 685	† 10.51
Hamilton	356,000	153,460	* 202,540	* 131.98
Kingston	18,355	4,247	* 14,108	* 332.19
Kitchener	1,265	11,765	† 10,500	† 89.25
London	110,600	85,010	* 25,680	* 30.21
Ottawa	41,600	104,200	† 62,600	† 60.08
Peterborough	2,532	7,235	† 4,703	† 65.00
Port Arthur	3,240	5,932	† 2,692	† 45.38
Stratford	1,153	6,060	† 4,907	† 80.98
St. Catharines	13,319	56,448	† 43,129	† 76.40
St. Thomas	9,025	2,400	* 6,625	* 276.04
Toronto	396,385	418,019	† 21,634	† 5.18
Windsor	42,800	71,405	† 28,605	† 40.06
Manitoba	**60,096**	**49,300**	*** 10,796**	*** 21.90**
Brandon	17,046	2,700	* 14,346	* 531.33
Winnipeg	43,050	46,600	† 3,550	† 7.62
Saskatchewan	**41,400**	**109,290**	**† 67,890**	**† 62.12**
Moose Jaw	3,200	33,950	† 30,750	† 90.57
Regina	29,850	13,240	* 16,610	* 125,45
Saskatoon	8,350	62,100	† 53,750	† 86.55
Alberta	**61,100**	**83,700**	**† 22,600**	**† 27.06**
Edmonton	18,600	56,000	† 37,400	† 66.79
Calgary	42,500	27,700	* 14,800	* 53.43
British Columbia	**85,763**	**43,345**	*** 42,418**	*** 97.86**
New Westminster	3,800	4,550	† 750	† 16.48
Vancouver	70,798	35,075	* 35,723	* 101.85
Victoria	11,165	3,720	* 7,445	* 200.31
Total—35 cities	**$2,387,045**	**$2,149,223**	***$237,822**	*** 11.07**

Now for the completion of much needed public work.

Men of Building and Construction Industries in Toronto Gather at Dinner Conference

The prospects for the building industries of Canada are bright. The spirit of co-operation was thoroughly aroused at the Ottawa conference some weeks ago, and at a supper in the Foresters' Hall, Toronto, on the evening of Dec. 19, which was made possible through the generosity of Mr. W. E. Dillon, President of the Toronto Builders' Exchange, and at which there were some 120 men of the trade present, this spirit was still in evidence.

After the good things had been enjoyed, Mr. Dillon opened the business part of the programme. He pointed out that there were important subjects to discuss and asked that all take part, not only the members of the Builders' Exchange, but the representatives present from other organizations, the Painters and Decorators' Association and the Toronto Society of Sanitary and Heating Engineers. The meeting had been called chiefly for the purpose of following up the Ottawa Conference, but there were other very important items to discuss. One of them was in regard to the demands made by the Building Trade League as to the extension of the Workmen's Compensation Act, which he considered absurd. The Lien Act was another important point which had to be dealt with.

Mr. Dillon said the Exchange had come through pretty hard times, but the veterans had held things together, though they had often to go down deep in their pockets to do it. He also referred to the memorial which had been gotten up, mainly through the instrumentality of Mr. Elgie. It had nearly fallen through completely at the Ottawa conference, and he thanked Mr. Jas. Phinnemore particularly for upholding it.

The Secretary of the newly-formed Association of Canadian Building and Construction Industries, Mr. A. H. Dancy, was then called upon to give a report regarding the doings at the Ottawa Conference (which was fully covered in the Contract Record of Dec. 4). Mr. Dancy pointed out that the new organization, which had been formed, primarily, through the efforts of Mr. Anglin, was on broader lines than anything ever before attempted. Delegates from coast to coast were present and the gathering had been one of the most important of its kind ever held in the Dominion. He had been particularly impressed by a remark made by the Minister of Public Works Hon. Mr. Carvell, when addressing one of their luncheons—that they could not expect to carry on an organization of this kind without a great deal of effort, but as the people of the Empire had learner how to wage war while they were waging it, so they would learn to run their organization when they had it under way. Mr. Dancy then proceeded with a condensed report of the proceedings at Ottawa.

Mr. Anglin on the New Organization.

Mr. J. P. Anglin, president of the Association of Canadian Building and Construction Industries, was the guest of honor of the evening. He was called upon by Mr. Dillon, as father of the association, to speak to them in regard to it and tell something of what the Montreal Exchange had done in reorganizing as a branch of it.

Mr. Anglin expressed his great pleasure in being able to be present and to meet so many of the building fraternity of Toronto. Fraternity and brotherhood among men engaged in the same business, he said, was most important. A returned officer had told a friend of his that the men "over there" did not need sympathy or pity, because they had enjoyed the finest brotherhood in the world, and the risk was worth it. If a little of that comradeship could be introduced into the industries of this country, we would have learned one of the most important lessons of the war.

Mr. W. E. Dillon, President Toronto Builders' Exchange and host at recent dinner conference

The speaker believed that the world had come to the parting of the ways. This terrible war could be described as a struggle of selfishness versus unselfishness, and our men were on the unselfish side. We called it a war of democracy, and that means unselfish brotherhood. On the one hand was the Prince of Peace and on the other, the Prince of Devils.

It was now a question of whether they would follow the broad-gauge man or the narrow-gauge man. While peace was being discussed, we must not be too confident that the victory over selfishness has been won. The broad-gauge man was not necessarily an educated man. Mr. Tom Moore, president of the Canadian Trades and Labor Congress, was a man who might not have had much education, but in his address at Ottawa, he had shown a very broad-minded attitude towards the question of labor and its relation with the employers. All would agree that the Bolshevik element could not gain the upper hand in this part of the world, but nevertheless they could not but notice that some were agitating along these lines.

The builders in the days gone by had many a good fight with the unions. To many still a union is symbolic with a strike, but they, as builders, appreciated the fact that the men should be permited to combine for collective bargaining. The labor movement in the world to-day is stronger than ever, and the speaker thought the policy should be one of co-operation in order to help the leaders of organized labor rather than one of opposition.

"What is the greatest pastime of the present age?" he asked. "Telling one's friends what the government ought to do." All classes of people believe they can run the government better than the government itself. So the builders had gathered in Ottawa with a view to studying the situation and telling the government what should be done. There was one policy that the government of every country would have to carry out—a policy of maximum production of natural resources, with two objects. One was to provide employment for labor and to increase exports and decrease imports. The other point was the "gospel of the square deal," and the builders and supply men got together to see that they got a square deal. There were other powerful organizations for the same purpose—the western grain growers associations, the trades' unions, municipal leagues, and so on. All these were essentially unions, though some resented the term. They were going into this organization where they would get a square deal and try to give it to the other fellow. This is an age of service as well as mutual benefit, and unless this new organization made it possible for them to be of service to one another and to the public at large as well, it would altogether miss its purpose. It should always consider the other fellow's viewpoint, as well as its own.

The Coming of the General Contractor Caused a Change.

The report they had heard of the Ottawa conference showed the great effort necessary to carry on. In addressing the Montreal Exchange the speaker had told them that since they were twenty-one years in existence it was time they had developed into full manhood. Ten years ago a changed condition came about by the introduction of the general contractor or contracting engineer, who was probably the real cause of upsetting the old state of affairs. The process, however, had been one of evolution rather than revolution. It had come in other countries as well as Canada, as a natural result of modern business methods, and there were to-day in the builders' exchanges the three distinct sections—general contractors, sub-contractors and supply men. These sections have, on some questions, almost diametrically opposed views. Many had dropped out of the exchanges and only the responsible men were left. This being the case, it seemed that the time had come for a change, and on discussing the question with other men of the trade they had come to the conclusion that they should organize a Dominion-wide association, and the result had been the Ottawa conference and the formation of the Association of Canadian Building and Construction Industries.

One of the striking things about the conference was the class of men present. They were an exceptionally fine lot of men, and the business of the convention had been carried on in an exemplary manner, which was largely due to the ability of Mr. Fred Armstrong as a presiding officer.

This, however, was only the beginning of the great work. They must carry on, and it was the object to employ as a paid secretary one of the best engineering contractors obtainable, so that the organization might be made strong and kept strong.

Mr. Anglin believed that the present held a great deal in store for the building industries. In his experience, the prospects had never been so bright, and he did not think that any of them wanted to revert to the pre-war conditions when business indeed was rushing but when competition was so bitter. In Montreal there had been a few contractors who were simply killing the whole business, who had taken the work at startlingly low prices, but when the slump came, these men had dropped off, leaving large debts unpaid. This competition had been encouraged by the architects and builders, but it was the fault of the builders, themselves, if they could not remedy the condition.

Referring to the constitution of the new association, Mr. Anglin said it was to be organized in three distinct sections. That triple organization in one should work right down through the local organizations. Each section should be autonomous, carrying on its own business in its own way without reference to the parent body, except at its own wish. In Montreal, as the result of a meeting on the 17th, a number of resolutions had been adopted with regard to reorganization. (The suggestions of the directors were unanimously accepted and are noted on Page 1015 of this issue. These resolutions would be reported to the annual meeting, to be held in about four weeks' time).

As builders, the speaker believed they would realize that a very complete and solid foundation had been laid and it remained to be seen what kind of superstructure would be erected—whether it would be a flimsy one or something substantial and permanent. He was satisfied that if the Toronto men followed along lines similar to those taken in Montreal that this Canadian association would grow into the strong organization that all desired.

Following Mr. Anglin's address, a resolution was presented to the meeting, moved by Mr. Geo. E. Stocker, that this meeting recommend to the Builders' Exchange of Toronto that they become affiliated with the Association of Canadian Building & Construction Industries, and that they bring the matter before the annual meeting of the Exchange. Mr. Stocker said that he had been greatly impressed with the work accomplished at the Ottawa conference, and he believed they had come to the parting of the ways when some definite action should be taken.

Mr. Young, of Baines & Peckover, said he was very much in favor of the new movement, but wished to know whether any action could be taken at the meeting. Mr. Dillon pointed out that they could only make recommendation to the Exchange.

Mr. Jas. Phinnemore spoke in favor of the proposed reorganization. The need, he said, was apparent, because the separate associations existed at the present time. There was the Builders' Exchange, the Painters' and Decorators' Association, and the Sanitary and Heating Engineers. While the Builders' Exchange might lose its identity, the organization would continue, taking in with it these existing organizations who go to make up the various sections of the building industry. He believed they had reached the point in their history when reconstruction was necessary. It could be done successfully in the building industry and he felt assured it would prove its salvation. "Canada for the Canadians" was a slogan with which he was thoroughly in sympathy. Let it be carried out in the national life, and let it be carried out as far as the building industries were concerned. But co-operation was necessary in order to do so. We must advance along the same lines as other institutions and organizations, or we would still continue to paddle our own canoe in small, secluded organizations.

Mr. Franklin, representing the Ontario Society of Sanitary & Heating Engineers, expressed his thanks for his invitation to the meeting. He said Mr. Anglin was the "broad gauge" man and that if the men present get the same pep as has been evidenced at the Ottawa convention, they would not hesitate to change the name of the exchange. Probably all of their little organizations had been small and selfish in their views, but he believed that all sections of the building industry must get into one big organzation before they would begin to make real profit.

Mr. Holmes, of Archibald & Holmes, speaking as a general contractor, said he was certainly in favor of the broad gauge proposition. Let everybody get together in the big organization in a four-square business way.

Mr. A. Matthews, of A .Matthews, Ltd., pointed out the seriousness of the steps proposed. It might be to their advantage, but he thought it would be hardly wise to disorganize the Exchange until they saw what the prospects were for greater results from the new association.

"Do you mean by changing the name that it is going to give a new birth?" asked Mr. Herbert Elgie. "Then by all means change the name." Building men should think for themselves and speak for themselves; they could not expect the public to do it for them. He believed that the reorganization would also be the means of bringing in many new men, and that it would be a great help to everybody all around.

Mr. Kirby, rising to speak on the situation, first pointed out that they owed Mr. Dillon a deep debt of gratitude for his courtesy. Personally he was of the opinion that they were right now at the parting of the ways, and that there was a wonderful outlook for the building trade in the not too distant future. The Builders' Exchange had done good work over a number of years, but the new organization had a much wider scope and a much broader viewpoint than had ever been suggested before. He was much in favor of Mr. Anglin's point regarding the taking in of the outlying suburbs and villages.

Mr. Sam'l Hughes said he had as much respect as any one for the Builders' Exchange, but he believed Mr. Phinnemore had voiced the right sentiment when he had spoken of reconstruction. The Toronto men should get right into the proposition, without waiting to see how it worked out elsewhere.

At this point a resolution was passed, on motion of Mr. Kirby, seconded by Mr. Davidson, expressing the thanks of the meeting to Mr. Anglin for coming down from Montreal to speak to them.

Mr. Stewart N. Hughes said he did not just like the wording of the resolution in regard to the reorganization of the Exchange. He thought it would be better to use the words "amalgamate and become a section of the new organization," rather than merely "affiliate." He had gone to Ottawa with a hazy idea of what was to be done, and had been surprised at what had been accomplished. The painters, he said, saw the advantage of the new association in its broader scope. It would enable them to go to Ottawa and make their demands or recommendations as the second largest industry in the country. Therefore they should all get together and become part of this organization.

Mr. Anglin said that perhaps they did not fully realize the situation across Canada. In Toronto they had a live organization, but this was not true throughout the country as a whole. They might retain the name, but he suggested that it would be better to change completely over. Regarding the cost, he said they could rest assured that they would have a voice in deciding what the relations of their district would be with the parent body and what the fees would be. It was the intention to make a number of classifications and allow the members to select whichever they wished to become a part of. It would not be fair to make a fixed fee, as contractors with big organizations operating in several parts of the country could afford much more than the smaller concerns. He did not think the eexpense would be heavy. The income required was from $15,000 to $20,000 a year. If possible they wanted to work out by-laws by which each member of the larger association would also be a member of the local organization. Any member of a local organization would be able to become a member of the parent association by paying a small additional fee, or might merely retain his connection with it through the local body.

Mr. Stocker changed the wording of his resolution from "affiliate" to "amalgamate" and it was then put to the meeting and carried.

Arbitrary Demands of the Building Trades League.

This concluded the discussion on the reorganization, and the subject was then brought up of the requests recently made to Premier Hearst and Hon. W. D. McPherson by the Building Trades League regarding changes in the Workmen's Compensation Act. Mr. Gander read the list of the changes asked for: (1) That the present rate of 55 per cent. of the workmen's former wages was inadequate to meet the liabilities; (2) That the entire cost of all accidents should be borne by the various industries covered by the Act, and that injured workmen should receive compensation to the full extent of their former wages; (3) As a lot of time is lost owing to weather conditions, the men should be compensated on the basis of union or the prevailing rate of wages paid in the cities or towns; (4) That the medical provision of the Act, which at present only covers the first month of disability should cover the whole period; (5) That the scope of the Act should be broadened to include private companies not engaged in the building trade; (6) That widows should receive at least $30 a month for themselves and $10 for each child under 16 instead of $20 a month and $5 for each child up to a maximum of $40 at present.

Mr. Gander believed the whole list of demands was altogether unreasonable. He pointed out that there was a big surplus in the treasury of the Workmen's Compensation Board, because the government in initiating the measure had not known just what funds would be required and had played very safe. The unions knew this and saw an opportunity of using up the money. As to the entire cost of accidents being covered by the industries and the workmen getting full compensation to the full extent of their wages, this made the employers liable for accidents which were entirely the fault of the men, and many of them would receive more when off work, as they had insurance with other associations. The 55 per cent. proposition had been quite satisfactory when first introduced, but now they were getting unreasonable. A letter was read from the Workmen's Compensation Board, in which it was stated that the firm of Wells Bros. Co., of Chicago, had paid in to the board $6,294.70, and that the compensation and medical aid awarded amounted to only $1,476.30, so that there was no burden falling on the local contractors on that account.

Mr. Gander said it was necessary that they present their claims as opposed to those of the workmen. Mr. Dillon said they wished to have the other associations join with them in appearing before the government, and Mr. Phinnemore and Mr. Franklin felt assured that their respective associations, the painters' and the sanitary engineers' would undoubtedly be eager to do so.

Discussion on the Mechanics' Lien Act

The Mechanics' Lien Act was the next question brought up. Mr. Jackson, of the Jackson-Lewis Construction Co., reported what action had previously been taken in regard to it. Early last winter a deputation from the Builders' Exchange went to interview Mr. Lucas, but not having sufficient backing were unable to have their requests put through. This summer, however, a deputation of the Provincial Association had met a better reception.

Mr. Jackson said that the supply men were asking the government to introduce a measure which showed complete disregard for the interests of the contractor. They had petitioned that the provisions of the Ohio Act be put through, one clause of which is as follows:

> "The original contractor, in order to obtain any payments from the owner, must deliver to the owner, if he or his agent can be found in the county, a sworn statement showing the name of every laborer who has not been paid in full and of every sub-contractor in his employ, and of every person furnishing material, machinery or fuel, with the amount due or to become due to such person, which statement must be accompanied by a certificate, signed by every person furnishing material, machinery, or fuel; the owner is entitled to retain all amounts due sub-contractors, laborers or material men as shown by such statements and until the statements are furnished the contractor has no right of action against the owner."

Mr. Jackson said that in answer to enquiries the Cleveland Builders' Exchange had informed them that the Ohio Act was not working satisfactorily there.

The last time they had interviewed Mr. Lucas they laid before him some amendments, as follows: (1) The Act does not give the sub-contractor and supply firms the same privileges to lien as the general contractor has; (2) The Act allows the owner to mortgage material and labor that he has not paid for; (3) The Act does not provide for liens on public works; (4) The percentage held by the owner is not enough to pay in all cases the claims of the sub-contractors and supply firms; (5) The cost of 25 per cent. allowed to lawyers is too much when the amount exceeds $100; (6) The workman has to go through the same formality as the contractor and he cannot afford the delay.

Mr. Lucas had suggested that they consult a lawyer and have these suggestions put in concrete form, and accordingly they had taken it up with Mr. Milligan. Regarding item six, it was decided that under present conditions, the workman was well enough able to take care of himself. On reconsidering item (4), they had decided it would be hard to change it without making it worse than at present. Item (3) could be taken care of by making the provincial provisions the same as those of the Dominion. Regarding item (2), Mr. Jackson read extracts from their lawyer's letter, stating such were the difficulties in the way of making any change that he could not see his way to prepare an amendment that he could support with reasonable arguments in favor of its adoption. With regard to item (1), however, Mr. Milligan had recommended that they propose the following amendments to the Act: "Section 22 of the said Act is amended by adding thereto the following sub-sections:—(6) If, within the time mentioned in sub-section 1, a sub-contractor has given to the owner or, in the case of a contract which is under the supervision of an architect, engineer or other person upon whose certificate payments are to be made, to such architect, engineer or other person, notice in writing of the sum owing to such sub-contractor by the owner or contractor, as the case may be, the claim for a line for such sum by such sub-contractor may be registered within seven months after the time mentioned in sub-section 1. (7) If, within the time mentioned in sub-section 2, any person who furnishes or places any materials, has given to the owner, or in the case of a contract which is under the supervision of an architect, engineer or other person on whose certificate payments are to be made, to such architect, engineer or other person, notice in writing of the sum owing to such person by the owner or by the contractor or by a sub-contractor, as the case may be, the claim for a lien for such sum by such person may be registered within seven months after the time mentioned in sub-section 2."

Mr. Alridge suggested that the draft submitted to the meeting be endorsed and forwarded to the Provincial Association for action. This motion was carried.

Mr. Elgie moved a vote of thanks to Mr. Dillon for his generosity and forethought in arranging and financing the meeting. This was unanimously and enthusiastically carried.

Brick Machinery

Messrs. Beique & Charlton, consulting engineers, 120 St. James St., Montreal, have been commissioned to make a report on the installation of a large brick-making plant. They desire to receive catalogues, prices, etc., from manufacturers of brick machinery.

U. S. army engineers do not favor the improvement of the St. Lawrence River from Lake Ontario to St. Regis, N.Y., to make those waters navigable for ocean-going vessels. Major-General Black, chief of engineers, states: "No improvement should be considered until the actual completion of the enlarged Welland Canal and tangible plans for the deepening of the Canadian St.Lawrence River channel and canals from St. Regis to Montreal indicate a prospective navigation by vessels of deeper draft than those now on the Great Lakes."

The Quebec Streams Commission have awarded a contract for the construction of a storage dam at Lake Brule, ten miles from Beaupre, P.Q., to the Laurentian Power Company, at a cost of $50,000. The plan is to construct three dams, a wooden crib dam filled with stone, and two small earth dams. The length of the wooden dam at the crest is to be 225 feet. The structure will provide additional water power for the Hydro electric plant of the Laurentian Power Co.

Impact Formulae for Bridge Design

THE scarcity of experimental knowledge of impact that has been shown by a review of tests and studies has resulted in the proposal of a group of formulae for the use of the bridge engineer in the design of various types of bridges.

Recognition of the fact that impact effects are less in solid-floor bridges than in bridges with light wooden floors, and less in solid-filled masonry arches than in steel bridges, has been quite general among bridge engineers for years past, but no formulae expressing this fact quantitatively have become established. Such formulae are needed for safe and economical designing.

J. A. C. Waddell, in a recent article in the Engineering News-Record, proposes a group of formulae, covering all the principal types of bridges and based, in part on a discussion of impact tests and, in part, on long experience in bridge design.

It is necessary first to establish clearly what impact in bridges really is. Many engineers believe that impact allowances either cover or should cover the prejudical effects of shock, vibration, alleged fatigue of metal eccentricities, secondary stresses, and minor imperfections in manufacture—in fact, that they usurp the function of what the late C. Shaler Smith used to term "the factor of ignorance." Such is not the case. As the bridge designer applies it, impact is the measure of the difference in the effects of any load applied dynamically and applied statically.

In amount, impact varies greatly with the governing features of the structure, the character of the loading, the velocity of the moving load, the conditions of track and rolling stock, etc. The bridge engineer naturally is concerned only with its maximum values; hence in determining formulae and diagrams for impact, the worst probable conditions are always assumed.

It is difficult to divorce the idea of impact from that of secondary stress; and in one sense it is impracticable to do so, because impact applies to secondary as it does to primary stresses. If the impact allowance increases the computed static primary stress in any bridge member 25 per cent., it will increase also by 25 per cent., any secondary stress that may exist simultaneously therewith in that member. Secondary stresses are due mainly to eccentricities of connections and to distortions of rigidly-connected members under load; and it is evident that these, as well as the direct or primary stresses, are augmented by shock or vibration.

Rabut's Formula Developed From Tests

The most important impact experimenting done in France was the work of the writer's friend, Col. Charles Rabut. He started his investigations in 1892 and completed them in five years. He obtained impacts ranging from 10 per cent to 50 per cent., and established for short spans the formula,

$$I = \frac{1}{1 + (L/4)\ 2}$$

where L is the span in meters.

J. Melan of Austria in 1893 made a mathematical analysis of impact for various span lengths, finding values varying from 77 per cent. for 5 m. spans to 15 per cent. for 120 m. spans.

In 1899 Prof. F. F. Turneaure of Wisconsin began his famous research on the effect of impact, which he has continued up to the present time. Of late years his work has been done in connection with the American Railway Engineering Association, in which he acts as chairman of a special committee. His first tests were made on plate-girder spans varying in length from 25 to 80 ft., and on truss bridges with spans from 100 to 200 ft., mainly under regular railroad traffic. The largest value for impact which he then found was 50 per cent. About the same time E. Herbert Stone conducted an extensive series of experiments upon impact on railroad bridges in India, finding a maximum value of 50 per cent. for short spans.

Schneider Formula Used for Many Years

As early as 1887 the late C. C. Schneider, afterwards president of the American Society of Civil Engineers, had proposed the formula

$$I = \frac{300}{L + 300}$$

in which I is the coefficient for impact and L is the length in feet of that portion of the span which is covered by the moving load when the member under consideration receives its greatest live-load stress.

This formula was used for many years thereafter, indeed until five or six years ago.

Theodore Cooper may be said to have covered the effect of impact in some of his earlier specifications for bridge designing, when he provided that the working intensities applied to dead-load stresses should be twice as great as those applied to live-load stresses. For instance, D being the dead-load stress and L the live-load stress, and the intensity for tension being 10,000 lb, for live load, the intensity for dead load would be 20,000 lb., and the sectional area required would be given by the equation,

$$A = \frac{L}{10{,}000} + \frac{D}{20{,}000} = \frac{2L + D}{20{,}000}$$

This means that the impact allowance for the live-load stress in any part of any kind of bridge of any span length should invariably be 100 per cent.; or, in other words, that the live load is always twice as effective (or destructive) as the dead load, no matter whether the piece under consideration be the beam hanger of a suspended cross-girder or the chord of a 500-ft. span. A number of American railway engineers, when writing bridge specifications for their systems, copied this feature and continued to employ it for many years, notwithstanding its prima facie lack of soundness.

Confusion Caused by the Fatigue Fallacy

For more than a decade many American bridge specifications were cursed with a provision against an imaginary fatigue of metal, based upon the results of the investigations of some German scientists, who, in their testing, stressed metal beyond the elastic limit many times in quick succession—often until rupture was accomplished. Sometimes the experiments were in either tension or compression only, but in some cases they were alternately in each. Certain American engineers, who apparently desired to be progressive, incorporated this fatigue-of-metal idea into bridge building by employing for intensities of working stresses factors involving maximum stress and minimum stress, thus greatly augmenting the work of bridge computers. A few American bridge specialists, however, among them the writer, from time to time protested against both the uselessness and the incorrectness of the alleged refinement; and gradually the objectionable feature disappeared from our standard bridge specifications. The logical reason for abandoning the burdensome practice was that fatigue of metal does not occur until after the elastic limit is passed, and in bridge designing it is customary to limit the intensities of working stresses to one-half of this for combined live, impact, and dead loads, and to seven tenths thereof for the most improbable combination of maximum stresses due to all the kinds of loadings that are ever considered in bridge designing as acting simultaneously.

Recent Experiments and Conclusions

In 1891 the writer, in a paper presented to the American Society of Civil Engineers, entitled "Some Disputed Points in Railway Bridge Designing," made an earnest appeal to the engineering profession for a systematic study of the question of impact on bridges; and in 1896, when preparing the manuscript of his "De Pontibus," he outlined a series of tests which he contemplated making. The project fell through, but early in 1902, when examining bridges on the International & Great Northern Ry. in Texas, the writer was able to make numerous experiments on deflections, using for the purpose a somewhat crude but quite efficient deflectometer constructed in his own office. He found impacts varying from 50 per cent. on an 88-ft. deck open-webbed riveted span to 20 per cent. on truss spans not exceeding 160-ft. in length. He learned then a very curious fact, viz., that for identical superstructures the amount of impact is dependent upon the character of the supporting sub-structure; because in the case of several spans of 159 ft. resting on masonry piers the percentage was 20, while it was 40 for two similar spans on small cylinder piers.

No other step of any importance was taken in America to study systematically the question of impact on railway bridges until 1907, when the American Railway Engineering Association appointed a committee to make a thorough investigation of it. That committee in 1911 issued a report indicating that it had experimented upon 21 plate-girder spans from 100 to 250 ft. in length, using generally enough loaded cars to cover the span tested, and employing speeds from 10 to 60 miles or more per hour. From that report are taken the following statements and conclusions:

For speeds under 10 or even 15 miles per hour the recorded impact was practically zero.

The chief factors in causing impact are unbalanced locomotive drivers, rough and uneven track, flat or irregular wheels, eccentric wheels, rapidity of application of load, and deflection of beams and stringers. (The term "impact" was considered by the committee to include any effect of the moving load which results in primary stresses exceeding the static stresses).

With the track and the rolling stock in good shape, the chief cause of impact is the unbalanced condition of the drivers of the ordinary locomotive. This condition does not exist in balanced four-cylinder locomotives or in well designed electric locomotives.

Recommendations of A. R. E. A. Committee

The committee corroborated the fact, discovered long ago by Prof. S. W. Robinson, that the maximum impact on a bridge is dependent upon how nearly its normal rate of vibration coincides with the times of the series of impulses from the unbalanced-driver loads. The critical speeds observed varied from 65 miles per hour for 60-ft. spans to 25 miles per hour for 300-ft. spans and to 20 miles per hour for a 440-ft. span. This corroborated the results of the writer's experiments, previously mentioned, in which he found for spans of 150 or 160 ft. critical speeds of 35 or 40 miles per hour. The committee also noted, as the writer had anticipated many years previously, that the impact on the separate main members of a span is greater than that upon the structure as a whole, or, in other words, that extenso-meter measurements give somewhat larger results than deflectometer measurements.

The committee suggested two formulae for impact based on these experiments, viz.:

$$I = \frac{1}{1 + L^2/20{,}000} \quad \text{and} \quad I = 60/L$$

where I and L have the same significance as in the Schneider formula previously quoted.

New Formula Proposed Two Years Ago

The summary of the committee's report given on p. 41 of Part 3 of the American Railway Engineering Association's Proceedings for 1911 (and reproduced on pp. 125 and 126 of the writer's "Bridge Engineering") makes very interesting reading.

Its subsequent report, published on p. 115 of the 1916 Proceedings, recommends a new formula,

$$I = \frac{1}{1 + L^2/30{,}000}$$

This is an improvement on the two others previously recommended; nevertheless, the curve which it represents passes beneath some of the plotted points for comparatively long spans.

In Volume CC of the Proceedings of the Institution of Civil Engineers, p. 178, there is a valuable paper by Charles William Anderson, entitled "On Impact Coefficients for Railway Girders," in which, among other matters, he deals with some experiments conducted in India by the government bridge engineer, H. S. Sales, deducing the following impact formula:

$$I = \frac{50}{50 + L}$$

The author of the paper states that " the formula has no direct scientific basis." It does not cover all the maximum results of the experiments, and he expresses some doubt about its being "sufficiently liberal for new girders."

Various Formulae Compared

While there have been numerous impact formulae advocated during the past three decades, only two of them have been employed at all generally—that of Schneider and the writer's modification of it; viz:

$$I = \frac{400}{L + 500}$$

Concerning the latter formula, the writer two decades ago in the first edition of "De Pontibus" stated as follows:

"This formula was established to suit the average practice of half a dozen of the leading bridge engineers of the United States, as indicated in their standard specifications, and not because the author considers that it will give truly correct allowances for impact. In spite of all that has been said to the contrary in the past or that may be said in the future, the impact method of proportioning bridges is the only rational and scientifically practical method of designing, even if the amounts of impact assumed be not absolutely correct; for the said methods carries the effect of impact into every detail and group of rivets, instead of merely affecting the sections of the main members, as do the other methods in common use."

In the twenty years since, the writer has found in his practice no reason for doubting the correctness of this opinion. It is true that the elaborate series of experiments conducted by the American Railway Engineering Association has shown that the old formulae give results which are too low for very short spans and are unnecessarily high for very long ones; but the variations on the side of danger have not been at all serious, nor have those on the side of safety been excessively extravagant.

Single-Track and Multiple-Track Impact Formulae

Basing on this graphical comparison, the writer contends that his single-track impact formula,

$$I = \frac{165}{L + 150}$$

provides better results than any of the others, being somewhat on the side of safety for spans longer than those which have thus far been tested for impact.

Unfortunately, the experimenting done thus far has been mainly upon single-track structures. Consequently, the formulae for double-track and multiple-track structures have had to be established by a priori reasoning. The writer's formula for steam-railway bridges is

$$I = \frac{165}{nL + 150}$$

where n is the number of tracks carried by the structure.

If we compare the values given by this formula for double-track and for single-track bridges, we find that the ratios vary from 0.71 for short spans to 0.55 for long ones, with an average of about 0.59. If we assume, which is more than probable, that a load on one track only will produce quite as large an impact effect on the nearer truss as that which would exist with both tracks loaded (because the vibrations from the two trains tend to check each other), the ratios of impact value for double-track and single-track structures will be the same as those of the live loads per truss for one track only loaded and both tracks loaded. These ratios very from 0.73 for short spans to 0.7 for long ones. As it is likely that a live load on a double-track bridge will give percentages of impact a trifle lower than the same live load would on a single-track bridge (because of the greater shock-absorbing capacity of the former), it it probable that the writer's formula when applied to double-track bridges is sufficiently accurate.

Concerning its correctness for a still greater number of tracks, it is almost entirely useless to make any surmise, because there are no data whatever to go by. The fact that for very long spans the formula when applied to multiple-track bridges gives values of less than 5 per cent. is a fair indication of its probable reliability within reasonable limits.

Impact on Electric-Railway and Highway Bridges

In establishing his impact formula for electric railway bridges,

$$I = \frac{120}{nL + 175}$$

the writer depended solely upon his judgment. The results of this formula for both single-track and double-track bridges are about 70 per cent, of those found by the formula for steam-railway structures. Judging by the correspondence with Professor Turneaure, previously referred to, it would have been more nearly correct to write it with 84 in the numerator. In that form it gives results so close to those of the writer's formula for impact in highway bridges, viz.,

$$I = \frac{100}{nL + 200}$$

that the latter may properly be assumed to cover both highway and electric-railway structures. When tested against the impact formulae for single-track and double-track steam-railway bridges, it indicates ratios varying from 0.5 for short spans up to 0.6 for long ones; hence, it should certainly be safe and suitable for both electric-railway and highway structures. In the latter the value of n is the total width in feet of the entire deck divided by 20, while in the former, of course, it is simply the number of tracks on the structure.

When one considers that rapidly passing motor trucks on the rough pavements of highway bridges are just as likely to produce high values of impact as are easy-riding trains on the comparatively smooth track-rails of electric-railway bridges, it is evident that there is no incongruity in employing the same impact formula for these two classes of structures.

Impact Allowances for Special Cases.

In figuring loads on foundations the impact is generally taken as zero. This is all right for heavy bridges, especially if the piers are massive; but for light structures resting on slender piers a certain amount of impact should be included, ranging from about one-half that of the trusses or girders for trestles down to about one-quarter of the same for long spans. This is a matter in which judgment based upon wide experience should govern. It must not be forgotten that the impact for a pier must be computed for a length of structure equal to the sum of the lengths of the two spans which it helps to support.

All the formulae for impact on railway bridges hereinbefore discussed are predicated upon the employment of open floors of the ordinary type of railway track; and those for highway bridges upon using plank flooring supported on timber joists. If, instead, a reinforced concrete base to support the track or the pavement be adopted, its massiveness will certainly aid materially in checking vibration and, therefore, in reducing impact; but to what extent no one can say until an elaborate series of experiments is made. In the writer's opinion, the solid floor will probably reduce the impact about 25 per cent.

Modifications for Concrete Open-Spandrel and Filled Arches

Again, the impact on reinforced-concrete arch rings is very much less than that on trusses of steel railway bridges with open decks or on those of steel highway bridges with wooden floors; because, in addition to the rigidity obtained from the reinforced-concrete base, there is that due to the massiveness of the cross-girders and columns or the cross-walls, as the case may be. On these accounts, the writer believes that the impact on arch rings for open-spandrel arch bridges may safely be taken as one-half of that adopted for the trusses of the corresponding steel structures with flooring of light type.

Finally, for the arch rings of earth-filled arch bridges, shock and vibration are so absorbed by both the massiveness of the concrete construction and the inertia of the superimposed earth filling that it will be proper to assume the value of the impact to be only one-fourth of that for the before-mentioned trusses of the corresponding steel structure with light flooring.

Recommended Formulae Summarized For Ready Reference.

Recapitulating, we have the following impact formulae to cover all kinds of bridges:

Steam Railway Structures:

For steel bridges,

$$I = \frac{165}{nL + 150}$$

in case of open floor;

$$I = \frac{124}{nL + 150}$$

in case of ballasted floor on concrete base.

For reinforced-concrete structures, excepting spandrel-filled arch bridges,

$$I = \frac{83}{nL + 150}$$

For spandrel-filled arch bridges,

$$I = \frac{41}{nL + 150}$$

Highway and Electric-Railway Structures.

For steel bridges,

$$I = \frac{100}{nL + 200}$$

in case of light floor;

$$I = \frac{75}{nL + 200}$$

in case of heavy, solid floor.

For reinforced-concrete structures, excepting spandrel-filled arch bridges,

$$I = \frac{50}{nL + 200}$$

For spandrel-filled arch bridges,

$$I = \frac{25}{nL + 200}$$

These eight formulas may be condensed into two, thus:

Steam Railway Structures,

$$I = \frac{165A}{nL + 150}$$

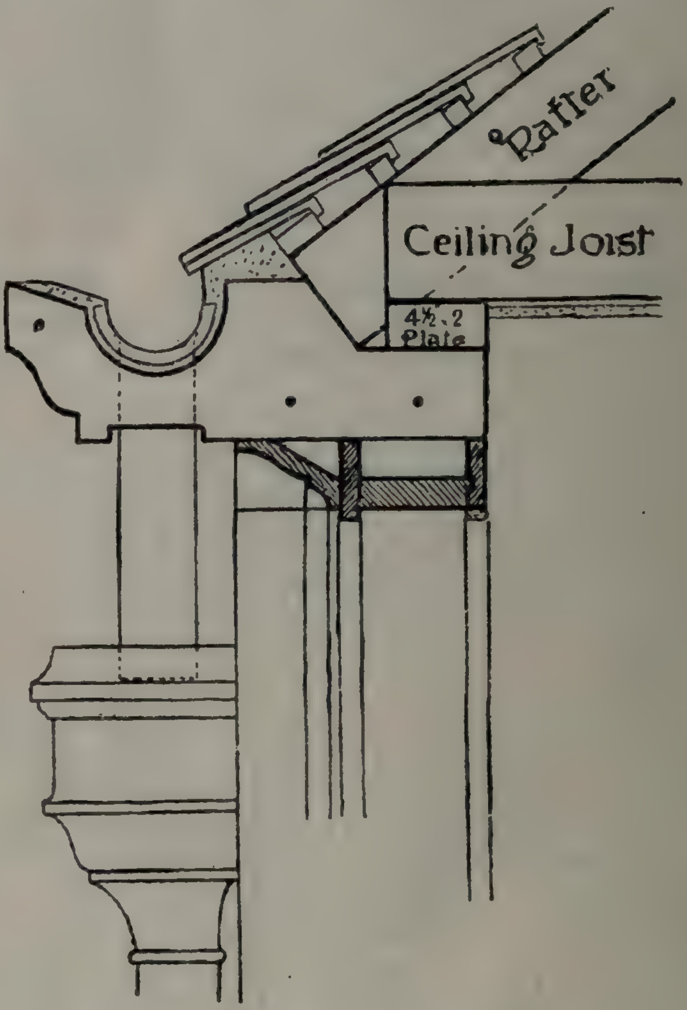
Highway and Electric-Railway Structures,

$$I = \frac{100A}{nL + 200}$$

where A has the following values: For steel bridges with open or light floors, 1.00; for steel bridges with heavy, solid floors, 0.75; for reinforced-concrete structures, excepting spandrel-filled arch bridges, 0.50; and for spandrel-filled arch bridges, 0.25.

Something New in Eaves Courses

MR. A. C. REMNANT, F.S.I., Surveyor of Anerley, London, has obtained letters patent for his invention, "Improvements in the Method of Constructing Eaves Courses in Buildings," the special features of which are making an eaves course of special shape in concrete reinforced, combining the functions of an eaves gutter, fascia, and soffit. The diagram shows the nature of the invention. The advantages claimed for the invention are economy in timber and metal, greater strength and stability, while maintenance is reduced practically to a minimum and initial cost is cheaper. The eaves course, being cast in situ acts as a continuous course or lintel. It is also claimed that it is particularly suited to housing schemes, in view of the saving to be effected in maintenance and repair.

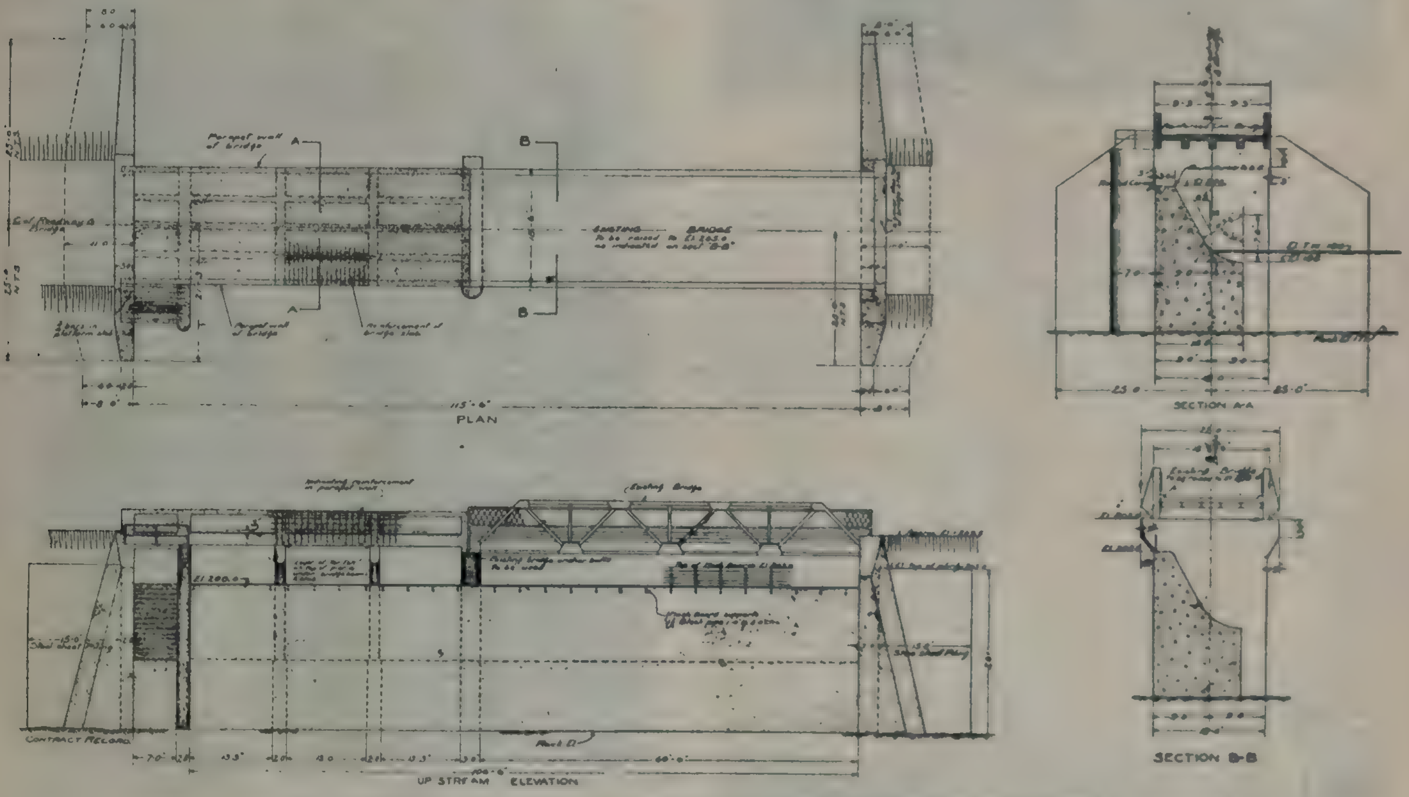


The Council of Frontenac county, Ont., has designated the road from Kingston to Joyceville as a provincial-county highway.

A committee has been appointed in Longueuil, P.Q., to undertake the building of a soldiers' memorial in that town.

New Concrete Dam and Bridge Over Lynn River at Port Dover

GOOD progress has been made by the Foundation Co., Ltd., of Montreal, on the construction work in connection with the new dam and bridge over the Lynn River at Port Dover, Ont., for Penman's Limited. A preliminary article covering the general features and an outline of the design of this work appeared in the September 25, 1918, issue of the Contract Record. In this article brief reference was made to the failure of the old dam and the necessity of increasing the length of the new work. About 60 ft. of the north embankment was washed out at the time of the collapse of the old dam and this space, in the new structure, will be spanned by a reinforced concrete bridge.



Plan, elevation and cross section of Port Dover dam and bridge being erected over Lynn River

The work was commenced at the north end of the dam and at the same time the contractors started the demolition of the old dam and abutments. The steel roadway bridge, which formerly spanned the river at this point, was lifted from its position and placed on the north bank of the river. The bridge weighed approximately ten tons and was removed by means of a derrick. When the new bridge abutments are completed this steel bridge will be lifted back into its new position as shown in the drawing. The remainder of the span will, as previously referred to, be accomplished by means of a reinforced concrete bridge, also indicated in the drawing.

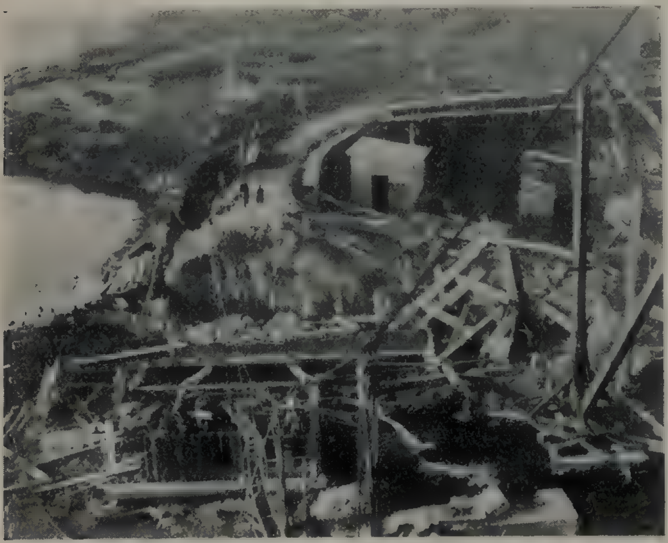
The first section of the work consisted of the north abutment, the sluiceway, 13 ft. of dam and the north pier for the reinforced concrete bridge.

Excavation.

In the excavation for the first section hard bedrock was encountered at elevation 177, which is about 13 ft. below water level at this point. In this section, 3-inch T. & G. sheet piling was used and the rangers were 12 in x 12 in. As the piling was driven down the material was excavated by means of a derrick and a clam shell bucket. The soil at first encountered was a hard stiff clay, but as the excavators approached the bed rock, considerable trouble was experienced on account of encountering large boulders and gravel. These boulders were so firmly wedged into place that it was difficult to move them from under the bottom of the sheet piling and they had to be worked out before the piling could be driven. During the work of excavation many old trees were taken out at a depth of about 10 ft. below water level. These trees were in a good state of preservation notwithstanding the many years, possibly centuries, they had been there.

Unwatering.

Very little trouble was experienced from water entering the excavation; the small amount that did enter was readily taken care of by means of a 3-inch pump. At one end of the excavation a rather had leak developed under the sheet piling and the contractors found it necessary to build a bulkhead about six feet back from the end of the excavation. The rock bottom was thoroughly cleaned and this portion allowed to fill up with water. Concrete was then deposited in this section by means of a deep sea bucket, to a depth of about 3 ft., and the bottom thoroughly sealed. In the remainder of the first section the concrete was deposited directly on the rock bottom. The rock encountered was of a very hard solid nature.

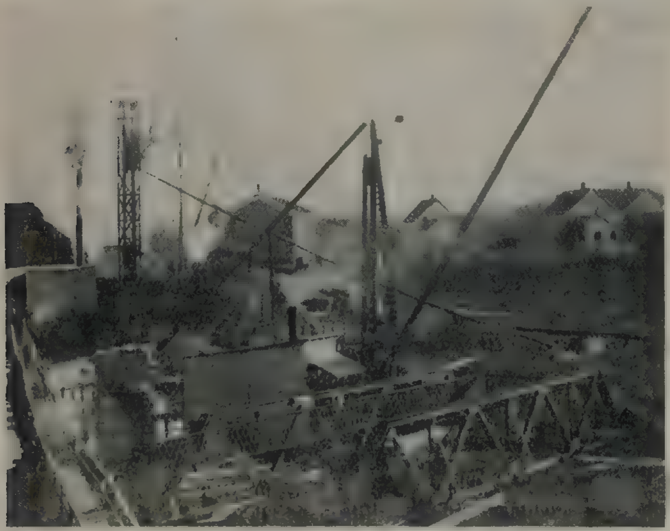

General View, work under progress in early stages

Temporary Sluiceway.

The flow of the river was taken care of by means of a temporary sluiceway which was constructed at the south end of the dam. Then the permanent sluiceway was completed at the north end of the dam the water was then diverted to this.

Excavation for Second Section.

The method used for excavating to bed rock for the second section of the dam was rather different from that used for the first. A great deal of material was taken out with a clam shell bucket before any sheet piling was driven. It was found that sheet piling was only necessary on the up-stream side of this portion of the work.

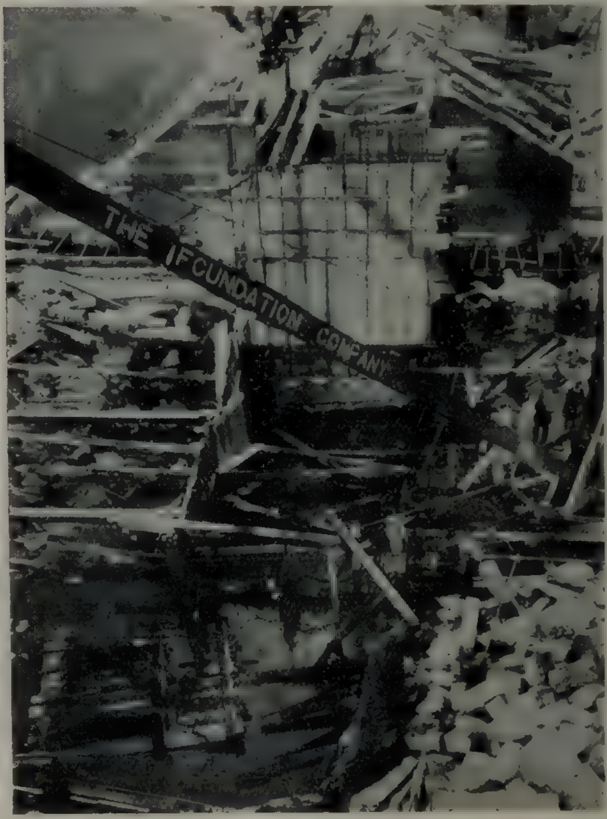

View showing location of plant with temporary foot bridge to left and steel roadway bridge in foreground

The excavated material was piled on the down-stream side of the dam and this formed such a substantial coffer dam that it was found possible to pump out the whole area between this and the old coffer dam which was constructed at the time the old dam collapsed.

On the second section of the work, bed rock was exposed with little difficulty except that a great deal of labor was involved in removing the old masonry abutments and the old concrete dam. The old dam was erected on timber cribbing and considerable labor was required in removing this old cribbing, which was accomplished by means of a derrick.

Excavation Flooded.

Some considerable delay in the work was caused by the water in Lake Erie backing up over the top of the down stream coffer dam and flooding the excavation. The dam is located about one quarter of a mile up-stream from the mouth of the river, but a strong south wind was sufficient to cause the water to back up, demolishing the form work that had been errected. Some of the wrecked form panels are shown in Fig. 2.



View showing first section of concrete work and the damage caused by flood to formwork of second section

The forms for the concrete were built up of 7-8 in. square edge boards with 2 in. x 4 in. uprights. All of the forms were securely wired and braced in position.

Aggregate.

Pit gravel was specified for use in all concrete work, but the pit gravel available was found by test to be deficient in large aggregate. The contractors decided to use a certain proportion of broken stone with the pit run gravel to enable it to meet the requirements of the specifications.

The sand and stone were brought to the site by teams. This was piled on the south bank of the river beside the operating plant. From this dump the sand and stone were lifted to the double hopper by means of a derrick and a clam shell bucket. The concrete was mixed at this plant and was deposited by means of a chute from a tower situated adjacent to the mixing plant as shown in the illustration.

Use of Plums.

The stone from the old abutments and pieces of concrete from the demolished dam were used for displacers or plums wherever possible, in all about 25 per cent. being used.

Reinforcement.

The concrete, with the exception of the concrete roadway bridge, is all mass work. The bridge floor slab is reinforced with 3-8 inch rib bars placed at 9 inch centers. The beams are reinforced with 1½ in. x 2¼ in. Khan bars, the top bars and anchors being of the same size.

The concrete for the mass work is mixed in the proportion of 1:2½:5, and for the reinforced part of the work, in the proportion of 1:2:4.

The plans and specifications for the work were prepared by T. Pringle & Son, Limited, industrial engineers and architects, of Montreal and Toronto, who are also supervising the construction.

The Maintenance of Macadam Roadways

By Mr. R. C. Heath*

WITHIN recent years the automobile has come into common use and it is evident to all that the roads are worse to-day than ever they were in spite of the thousands of dollars which are constantly being spent on them. You seldom ride over a smooth macadam road with no holes and rough places. We do not want to make our roads smooth just because it is more pleasant to ride over them—it is a well established fact that a rough, badly shaped road will wear out much quicker than a smooth one.

Macadam roads wear out in two ways; first, the direct contact of the wheels of vehicles and the action of the elements wear out the surface; second, the weight of the vehicles and frost action cause the stones of the road metal to wear on one another inside the pavement itself. It certainly stands to reason that if a road is full of holes the road metal wears out quicker both internally and on the surface because a loaded vehicle, instead of rolling smoothly over the surface, pounds and tears at the metal as it is hauled into and out of the depressions.

Both steel-tired vehicles and automobiles injure a macadam road but in different ways. Steel-tired vehicles grind up the road metal into dust and the automobile sweeps this dust off the road surface. There is undoubtedly less internal wear on a road where the traffic consists of automobiles and motor trucks because the rubber tires and improved springs absorb a great deal of the shock of the wheels striking the surface, and the surface wear is also less, because rubber tires do not grind the stones into dust. The effect of such traffic is to make the metal fall apart or ravel by removing the dust which binds the stones together. Steel-tired wagons cause more internal wear because the full effect of the load is carried to the metal as if it had been struck with a hammer; and such tires also cause more surface wear by grinding the metal into dust. A macadam road, subjected to steel-tired traffic alone will last a long time, simply because the dust is not removed by slow-moving traffic and the road metal does not ravel. Most of our roads are carrying to-day a mixed traffic consisting of heavy wagons, automobiles and motor trucks and are, therefore, wearing both internally and on the surface. Our maintenance problem then is to care for the roads in such a way as to prevent as far as possible these two kinds of wear.

To prevent excessive internal wear, we should keep the holes filled and the surface smooth and even. During construction, every care must be used to keep low or high places out when spreading the metal and to thoroughly bind the stones together with screenings so that all voids are filled to the very bottom of the metal. I consider that the most important part of any macadam work is the spreading of the metal and the thorough filling of voids in the stone.

To Prevent Wear and Raveling.

To prevent surface wear, the surface must be covered with some kind of material that will prevent the wheels from grinding directly on the metal. To prevent raveling the surface must be covered with some kind of material that will prevent the automobiles from sweeping the dust from between the stones. Fortunately there have been developed several materials which will perform these services, two of which will be used as illustrations. They are asphaltic oil, a product of the petroleum oil well, and tar, a product of the coal mine and gas-house. These materials are spread over the surface in a thin sheet and covered with sand or stone chips. There is considerable prejudice among many people against the use of oil or tar on the road surfaces because of the results obtained by many cities on their streets. The reasons for these failures are generally the same everywhere—carelessness in applying the bitumen, failure to clean the road surface and failure to cover the bitumen after the application. Bitumen must be applied in small quantities on an absolutely clean surface and must be covered with sand, screenings or chips—the material must be applied in small quantities so that it will not roll up under traffic and because only a little is needed to give the result; the surface must be clean so that the material may stick to the stones, because it will not stick to dust; the material must be covered so that it will not be removed on the wheels of vehicles, and so that a mat will be formed over the surface.

Carpet Treatment.

The use of oil or tar on road surfaces is frequently called "carpet" treatment. This name is a good one because the effect of oil or tar is a great deal like that of a carpet on the floor of a room. You have all noticed the floors of the hallways in the old court houses—hollows are worn into the hard wood sometimes as much as an inch deep by the shoes of the hundreds of men who have walked there. Now compare the condition of this floor with the one in the county judge's office, where there has always been a carpet on the floor—it is not marred or worn at all, because the soft yielding carpet has taken the wear. Of course, the carpet has worn out from time to time and a new one has had to be laid, but the main result has been obtained—your road is not worn out.

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*Before Kentucky Highway Engineers Association

Do not think that if you apply oil to a road or patch the holes once or twice your problem is solved, that you can then take your outfit away and build a new road somewhere else with no more thought for the old road. That is not real "road maintenance." The only way in which maintenance can be successful is for the engineer to keep everlastingly at it. Patrolmen must be employed to take care of the road and must start at work on the very day it is finished. Holes must be employed to take care of the road and must be ready on the job to see them start. The surface must be kept unbroken so that no water can get into the metal and soften it so that a hole can start. If you are not going to take the best possible care of your roads it is better not to start at all; it is a waste of money and a waste of time to half repair a road.

Economy to Maintain Roads.

People say it costs too much to maintain roads by using these new fangled methods—oil and tar and black greases of all kinds. The people are wrong; and they are wrong because they do not understand the financial end of road building. Suppose it costs $3,000 per mile to place the metal on this road and it will last, with no care at all, for three years. At the end of that time it will be necessary to re-surface. Even if you have not spent one dollar on that road it stands you exactly $1,000 per mile per year. Every hole in it represents a dollar or two that you spent to put down the metal, which has disappeared somewhere. Now, wouldn't you be willing to spend $1,500 a mile to make the road last three years more? That expenditure would make the road cost $4,500 for six years' service, or $750 per year. But if you let it go without repairs it will cost you $6,000 for six years' service, and your road is always getting worse instead of better. In other words, spend $1,500 to save $1,500, not to mention the saving in wear and tear on your wagons and automobiles. That certainly looks like a good investment. These figures that I have given are reasonable ones. How many of you men have seen macadam roads which are in good shape after three years' service? I do not believe there is a single heavily traveled macadam road in this state, which is three years old, that does not need resurfacing right now, and I do not believe there is one county which has spent an average of even $100 a mile on its macadam roads since they were constructed. Most of the counties have spent not one penny for maintenance. If you will spend one-half in maintenance of what you are losing by not maintaining, your roads will always be good and at the end of ten years you will have something to show for your money beside sad experience and worn-out roads.

The opinions of engineers regarding the best methods of repairing roads will differ many times, but all will agree that no road builder can afford not to maintain his roads. The people are not only entitled to roads, but they are entitled to good roads. They are paying for roads because they expect to get their money back in service from the roads not because they want to indulge in an expensive luxury. If the roads are not kept in good condition the people are not getting the service for which they have paid. No man will own a house nowadays without having it properly insured, and he is willing to pay a fair premium for the protection against loss. "Road maintenance" is simply "road insurance," and the people must pay the premium in order to be protected against the wearing out of their roads.

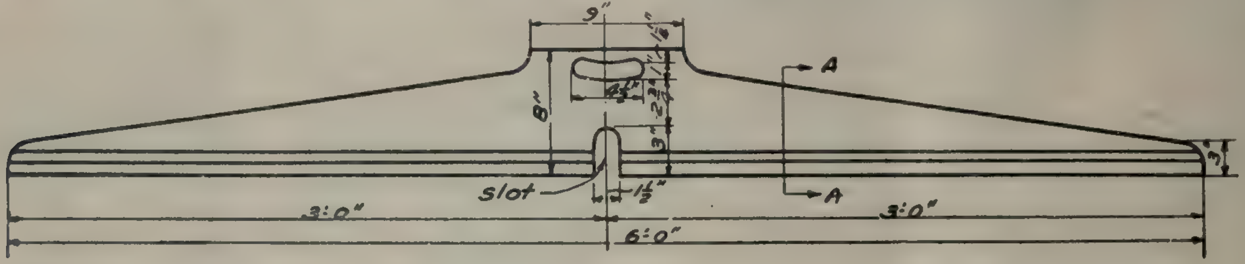
In conclusion, let no road engineer think that maintenance work is beneath his dignity as a road builder. The biggest men in the road game to-day are studying the problems of maintenance, realizing that they are the hardest problems that remain to be solved. Maintaining a road means much more than throwing a few stones into the holes or spilling a little oil on the surface. There is plenty of opportunity for careful study and experiment, and all such work must be done with the greatest skill and care.

Maintenance work is not difficult in itself, but most engineers fail in maintaining roads because they will not take pains enough in getting careful work. The secret of successful maintenance is all in the care with which the work is done.

Straight-edge for Testing Joints in Concrete Pavements

By F. M. Balsley, Division Engineer, Wisconsin Highway Commission

THE split float has a proper place in finishing concrete pavements, but it is not by any means sufficient for finishing at joints, because the strike-board nearly always causes an excess of concrete on one side or the other of the expansion joint material, and the split float simply finishes the edges of the slabs, still leaving the hump which spoils what might otherwise be a good riding pavement. In the accompanying sketch there is shown a straightedge which is used as a gauge to determine the relative elevation of adjacent slabs by placing the slot over the protruding joint filler immediately after the concrete has been struck off. If there is an excess of concrete on either side of the joint, the straightedge is rocked back and forth and pressed down until the outer ends touch the finished slabs. The concrete so marked is removed and the surface refinished to grade. Insufficiency of concrete, as well as excess, can as easily be detected and corrected. When the straightedge rests on both slabs for its entire length, the work is acceptable.



Proper use of this straightedge insures that adjacent slabs will be on the same plane. This device has become quite popular in highway construction circles.

Mainly Constructional

East and West—From Coast to Coast

The Trent Valley Canal is to be completed from Lake Simcoe to Georgian Bay, according to recent announcement. The section between Lake Ontario and Lake Simcoe is already opened.

Work on the reclamation of Catfish Pond, Toronto, is to be continued next year. Owing to the increased cost of labor, it will be necessary to provide an additional $15,000 in the 1919 estimates.

The ratepayers of Brantford, Ont., will vote next January on a by-law to raise $125,000 for an extension of the street railway to Terrace Hills; also on a by-law to erect a new school in Ward 5, at a cost of $70,000.

The Vancouver city council has passed by-laws to raise money for the following purposes: $750,000 for the erection of a Victory Hall; $350,000 to acquire timber rights on Seymour creek; $200,000 for repairing roads, streets and alleys.

The board of trade of Vernon, B.C., have made representations to the Dominion Government and to the government of British Columbia calling for the construction of a branch line of the C. N. Ry. extending from Kamloops to Kelowna, with a spur from Vernon to the Lumby District.

The Winnipeg approach of the Provencher bridge is now open to traffic. Although the temporary wooden bridge approach won't be taken away for the present, vehicles can reach Christie street in a direct line. The new approach is not completely finished, but it will likely be completed in the spring.

The city council of Sault Ste Marie, Ont., has decided to submit a by-law to the ratepayers on Jan. 7, to raise $40,000 by debentures for the erection of a soldiers' home for the benefit of returning men and as a memorial to the men from Algoma district, who have made the supreme sacrifice in the war.

Last year there were 1,316 miles of rural roads throughout the Province of Manitoba systematically dragged, according to Mr. Fred Bentley, secretary of the Manitoba Good Roads Association. Next year with the return of farm hands from the front, Mr. Bentley expects there will be an increase to at least 2,000 miles.

The Alumni Association of the University of Toronto is planning a campaign to raise $500,000 for the provision of a suitable University War Memorial. Half of this amount would go to maintain scholarships for veterans and other undergraduates, while the remainder would be used to erect a memorial to the 'Varsity students who have fallen in the war.

On the occasion of a recent visit of the directors of the Canadian National Railway Board to Fredericton, N. B., the mayor and members of the Board of Trade presented the claims of Fredericton in connection with the establishment of a union station, better terminal facilities, and other improvements. President Hanna said their representations would receive careful consideration.

The Mullen Construction Co., of Pittsburg, Pa., are taking over the dry dock and shipbuilding yards at Prince Rupert, B.C., in order to carry out a steel shipbuilding contract for the Dominion Government. It is understood that it is the intention also to build wooden vessels at Prince Rupert, and that the total tonnage of steel and wooden craft will amount to 60,000. The Mullen Co. propose to spend at least $500,000 in improvements, including the erection of plate and angle shops, assembling shops and sheds, and extra equipment.

A scheme is proposed in St. Thomas, Ont., for establishing a memorial drive in honor of the men of that city who have given their lives in the war. The board of trade was responsible for the suggestion, and a committee has been appointed consisting of City Engineer Ferguson, County Engineer Bell, Dr. F. E. Bennett, R. M. Price, E. A. Smith, C. Montgomery and A. A. Ingram, to plan out the most desirable route.

A meeting was recently held in Ottawa under the auspices of the local board of trade to discuss the question of a memorial to Ottawa men who have served the Empire in the Great War. It was not decided what form the memorial should take, but the conclusion was reached that it should not be a hospital, and that it should be separate and distinct from any undertaking of the Dominion Government. No definite action is to be taken until the plans of the Government are learned.

The Toronto Building Trades League recently submitted a resolution to the Board of Control recommending that the city at once plan the erection of 5,000 six-roomed houses on lots at least 25 ft. wide and 150 ft. deep—the price of these to be approximately $2,750 each. It is suggested that the government loan be taken advantage of and that the houses be sold on easy terms to soldiers who enlisted from Toronto, preference to be given those with the largest number of cihldren. The Building Trades League also recommends the erection of a Victory Hall near Carlton and Yonge streets, with seating accommodation for 10,000 people, and the proceeding with all local improvement work.

Toronto's plans for park and boulevard development are taking definite shape. The Parks Commissioner states that a complete system of development has been mapped out, involving an expenditure of $7,000,000, and that the whole project will be laid before the city council early in the new year. He proposes the construction of fifty miles of continuous boulevard driveways in a circular route around the city. The driveway will encompass the entire city from the east to Jane street on the Humber, north to the limits of North Toronto and down the east side and over the reclaimed land and Toronto Island, crossing the eastern and western gaps by means of bascule bridges. It is planned to connect this whole system with the projected continuation of Rosedale Ravine. The programme also calls for the opening up of twenty new playgrounds for the children of the city.

Dominion Housing Committee Formed

A housing committee of the Dominion Cabinet has been formed, consisting of Hon. N. W. Rowell, president of the Privy Council, chairman; Senator Gideon Robertson, Minister of Labor; Hon. A. K. Maclean, vice-chairman of the Reconstruction and Development Committee, and Hon T. A. Crerar, Minister of Agriculture. This committee will immediately take up with the province the question of housing accommodation and will take such measures as may seem necessary or helpful towards the relief of the situation and the furtherance of the Dominion Government's plans for assistance.

It is stated that the committee will (1) formulate the general principles which should be followed in any housing scheme in order to secure the results aimed at, and (2) communicate with the governments of the several provinces with a view to agreeing with them upon any general scheme of housing, that the fund of $25,000,000 authorized to be set aside for housing by the Dominion Government may be applied for the purposes contemplated

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Hamilton, Ont.
By-law will be submitted January 1st to expend $117,000 for construction of system of storm sewers east of Ottawa St., and the necessary outlet therefor.

St. Norbert D'Arthabaska, Que.
Tenders will be called to close during March for the opening and grading of public highway for Municipality. Supt. Alfred F. Paris.

Windsor, Ont.
By-law will be submitted January 1st for $350,000 for establishment of filtration plant for improving waterworks system.

CONTRACTS AWARDED

Rosser, Man.
Work is to start gravelling roads for Rural Municipality of Rosser: General contractor, M. Duncan, care of Harstone Bros., Lindsay Bldg., Winnipeg.

Railroads, Bridges and Wharves

Hawkesbury, Ont.
Department of Public Works, Ottawa, contemplates erection of bridge costing $30,000.

Owen Sound, Ont.
County Council contemplates rebuilding bridge which collapsed. Engineer Robt. McDowall.

St. Thomas, Ont.
City Council contemplates extension of street railway. Clerk, W. B. Doherty.

Vancouver, B.C.
Great Northern Railway, 607 Hastings W., contemplates construction of dock.

Quebec, Province of
O. Arcand, Engineer, Notre Dame St. Three Rivers, has received the contract for the material for painting the Wayagamach bridge.

Public Buildings, Churches and Schools

Delisle, Sask.
Town Council contemplates erection of municipal hospital. Mayor, S. Moulton.

Hamilton, Ont.
Board of Education contemplates erection of public school. Secretary, R. H Foster, 18 Cottage Ave.

Ottawa, Ont.
Dominion Government has appointed commission (Sir Edmond Walker, Toronto, Chairman) to prepare report re location and detail of building to house war trophies.

Penticton, B.C.
Town Council contemplates erection of memorial and library is most favored. Chairman of committee, K. McKenzie

Port Arthur, Ont.
Department of Public Works, Toronto, contemplates erection of court house costing $150,000 in the Spring.

Regina, Sask.
By-law is to be submitted for erection of public school costing $125,000 for School Board. Secretary, J. H. Cunningham.

Saint Anges, Que.
Plans are in progress and tenders will be called about January 1st for erection of church for Congregation. Architect Lorenzo Auger, 39 St. John St., Quebec

St. John, N.B.
Tenders are being received by R. C. Desrochers, secretary of Department of Public Works, Ottawa, until noon, December 30th, for erection of military garage.

Truro, N.S.
Town Council contemplates erection of memorial hospital. Clerk, H. McDougall.

Unity, Sask.
By-law is to be voted on by municipalities of Grass Lake, Senlac, Round Valley and Unity to raise $25,000 for erection of union hospital. Secretary, J T. Roper, Salvador, Sask.

Wilcox, Sask.
School Board contemplates erection of school next Summer. Address, Secretary of School Board.

CONTRACTS AWARDED

Burlington, Ont.
Pigott, Healy Construction Co., 36 James St. S., Hamilton, have been awarded contract by Department of Public Works, Ottawa, for active treatment ward for military hospital.

Hamilton, Ont.
School costing $300,000 for Board of Education; secretary of board, R. H Foster, 18 Cottage Ave.: Natco partition and enclosure wall tile, National Fire Proofing Co. of Canada, Ltd., Plains Rd.; painting, J. Church, 8½ John St. N

Moncton, N.B.
Foundation is in for church costing $3,500 for Reformed Baptist Church, c/o Rev. S. O. Baker: Electrical work, G. F Perry.

Montreal, Que.
Sunday school costing $25,000, for Wesley Methodist Church: Roofing, Geo W. Reed & Co., Ltd., 37 St. Antoine St.; painting, Alex. Craig Ltd., 41 Jurors St

Business Buildings and Industrial Plants

Amherstburg, Ont.
Henry Robidoux contemplates erection of warehouse costing $7,000 next Spring.

Hensall, Ont.
Plans are to be prepared for alterations to departmental store for T. C Joynt.

Moncton, N.B.
Site has been purchased and building will start in Spring for bank for Canadian Bank of Commerce, King St. W. Toronto.

Jas. Weldon contemplates erection of business block in Spring.

North Devon, N.B.
Thomas Pink Co., Ltd., Alexander St. Pembroke, Ont., contemplates improvements to factory costing $7,000.

Ojibway, Ont.
Work is to start soon for steel manufacturing plant costing $20,000,000 for Canadian Steel Corp. Ltd. Gen. manager, Ward B. Perley.

Purvis, Man.
Andrew Hyslop contemplates erection of general store in Spring.

St. Catharines, Ont.
Work has started for dairy barn for McSloy Bros. Architect, T. H. Wiley 128 St. Paul St. Masonry, carpentry and steel will be let and steel, roofing flooring, hardware, hollow tile for silos and stable equipment is required.

St Tite, Que.
Acme Glove Works contemplates erection of extension to factory costing $15,000.

Acme Shoe Pack Co. contemplates erection of extension to factory costing $10,000. Manager, J. H. Massicotte.

Saskatoon, Sask.
Plans are in progress for cold storage building for Saskatchewan Co-operative Creameries, Ltd., 502 Northern Crown Bldg., Regina. Architect, Mr. Garvin care of company.

Smithers, B.C.
Bulkley Valley Farmers Institute contemplates erection of flour mill and warehouse. Secretary, Mr. Croteau, Telkwa.

Three Rivers, Que.
Foundation is in for frame and brick office costing $4,000 for Pothier & Cloutier & Baptist Ltd., lumber dealers

Toronto, Ont.
Acker Furniture Co., 236 Danforth Ave., contemplates erection of furniture store, etc., next Spring.

L. W. Trull, 751 Broadview Ave., con-

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